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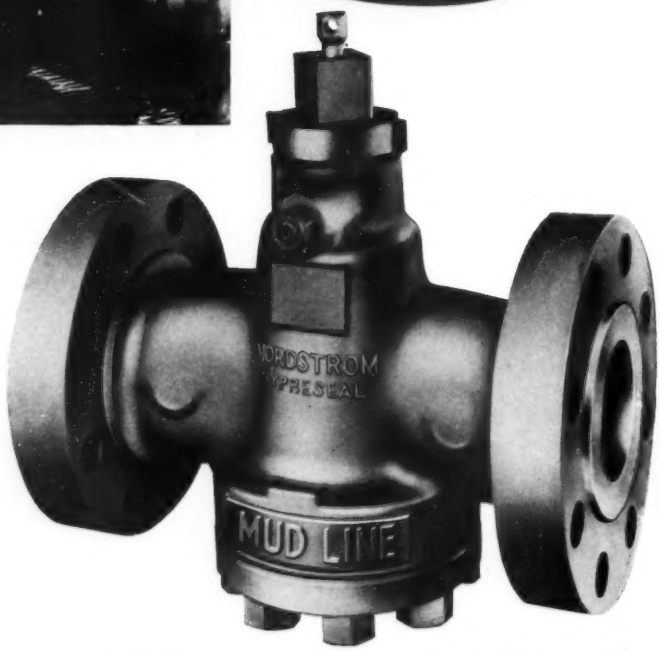

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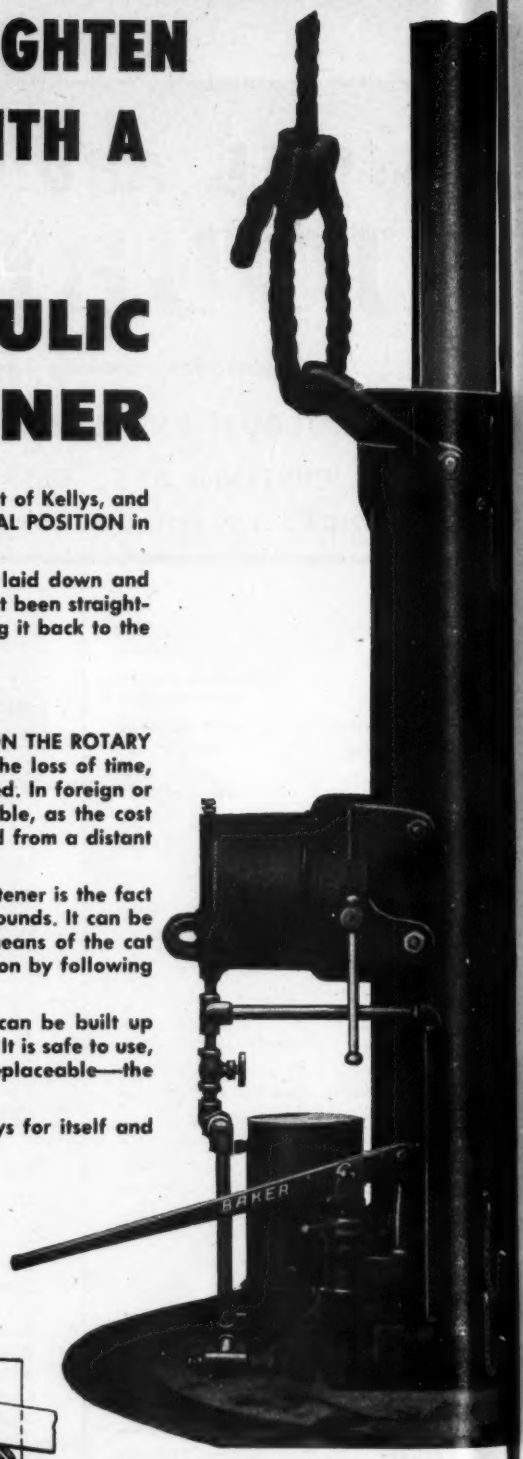
THE BEST WAY TO STRAIGHTEN KELLYS AND PIPE IS WITH A *BAKER* PORTABLE HYDRAULIC KELLY STRAIGHTENER



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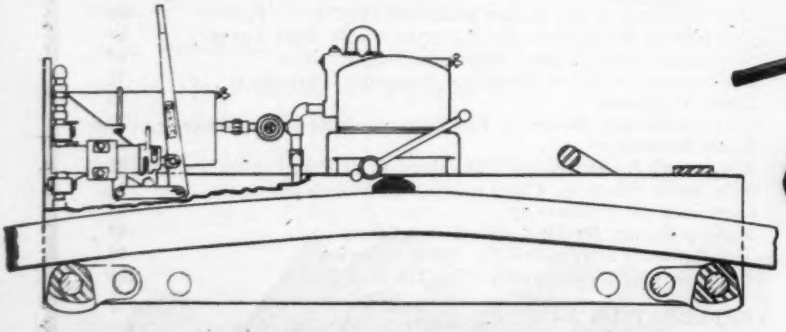

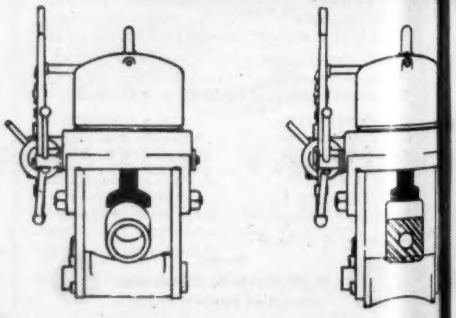

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The O'Mahoney Findings

INEVITABLY there will be diverse reactions to the final report of the special O'Mahoney Senate committee investigating petroleum resources. To those who have followed the committee's activities through several hearings over the past 2½ years, there is a noteworthy absence in the report of any effort to seek personal or party political advantage by the 11 senators who conducted the investigation.

Possibly the constraint as to findings and recommendations which characterizes the report stems from the fact that the committee was greatly impressed by the accomplishments of the oil industry in the Allied war cause. The senators, after listening to the presentation of thousands of pages of testimony, agree that nothing should be done which will weaken the domestic oil industry—to the end that it will again, if necessary, be able to respond adequately to a national emergency. They agree that the future course of world events will largely revolve around the establishment of sound international oil policies with emphasis placed on what is done in this country over the next several years.

The report points to a weak situation in our petroleum policy having to do with the operations of our nationals in foreign countries. A question which the committee does not attempt to answer is concerned with the application of this country's antitrust acts in world trade. It is agreed, as Senator Moore pointed out in a concurring report, that the acts apply when the freedom of interstate commerce is involved, whether the restraint has a domestic or foreign source.

It should be apparent that our nationals in their activities which are entirely foreign should not be circumscribed by acts designed solely for domestic activities. In most countries oil operations are directly controlled by governments through monopolies or cartels. A United States national either conforms to these controls or the business goes elsewhere.

The foreign production interests of American nationals far exceed the combined investments of all other countries exclusive of the U.S.S.R. Additional tremendous expenditures are necessary to round out these operations, and these programs are possible only if the United States companies are free to adjust their activities to the regulations of other countries. The objective of American companies will always be to further open markets comparable to those upon which this country's oil activities are based.

This is an essential part of a national oil policy in which, as the report states, "petroleum, instead of being a possible source of conflicting ambitions among rival powers, may become a lever to raise standards of living of people everywhere and to promote the dissemination throughout the world of the principles of human liberty."

Importance of Domestic Industry Stressed in O'Mahoney Report

by Henry D. Ralph

WASHINGTON. — A national oil policy conforming very closely to suggestions of the American petroleum industry is recommended in the final report of the Senate petroleum-resources committee.

The first principle of American petroleum policy, it declares, should be to sustain our domestic supply of petroleum and to maintain the American system of competitive free enterprise at home and abroad.

The report was filed by Chairman Joseph C. O'Mahoney of Wyoming January 31, the last day of the life of the special committee which was created in March 1944, and was based on testimony taken at extensive hearings. A resolution to perpetuate the petroleum committee has not yet been acted upon by the Senate. Sen. E. H. Moore of Oklahoma filed a supplemental concurring report giving his personal views on three or four points raised in the report.

No specific legislation is recommended, but the report outlines the general objectives of both congressional and administrative action in several fields. If given the consideration it deserves, the report should be a potent influence on all branches of the Government when dealing with oil matters.

The report rejects the idea of hoarding petroleum reserves for future generations, stressing the need for a vigorous domestic industry and encouragement to new development. It also gives no support to suggestions for government operation, expanded federal control, or international regulation.

Synthetic Development Favored

For military security the report recommends reliance on development of synthetic liquid fuels.

In the foreign field the report pins its faith on advancement of world peace and higher standards of living abroad, plus the suggestion that corporations operating abroad be required to disclose to the Government more details of their undertakings.

For the domestic industry it recommends tax and antitrust policies to protect independent operators, state and federal cooperation in conservation and secondary recovery, and encouragement to new exploration and development.

The committee's major recommendations are summarized in the concluding section under the heading, "Elements of a National Oil Policy," as follows:

ELEMENTS OF A NATIONAL OIL POLICY

"Every American unites in the national commitment to dedicate our country's energies and its will, as well as its hopes and prayers, to the establishment of world peace. International understanding in both commercial and political fields is the aim of our people, but, until that understanding is achieved, the United States must under no circumstances abandon to chance its industrial and military capacity to uphold its ideals.

"This nation now faces two alternatives:

1. "To await with hope the discovery of sufficient petroleum within our boundaries that the military requirements of the future will occasion no concern, and in the meantime to depend upon foreign oil and trust that war will not cut off our imports; or

2. "To take steps to guarantee a domestic petroleum supply adequate for all eventualities by means of: (a) Incentives to promote the search for new deposits of petroleum within the boundaries of the United States and in the Continental Shelf; and (b) The continuation of the present program looking to the manufacture of synthetic liquid fuels to supplement our domestic crude supply.

"The first principle of American petroleum policy, therefore, should be to sustain our domestic supply of petroleum and to maintain the American system of competitive free enterprise at home and abroad. The second principle is to make human freedom the cornerstone of our policy, liberty and opportunity for people without discrimination or restraint, both within and beyond our borders.

"To these ends we should:

1. "Enact those laws which are most conducive to stimulating additional exploration and development in the United States. Encourage conservation to prevent waste. Promote interstate compacts so that our reserves may be expanded and used in the public interest, but guard against any danger of misusing conservation laws to restrain unduly any operator. Administer the public lands, not primarily as a source of governmetal revenue, but for the purpose of stimulating private initiative in discovering and developing oil on the public domain.

2. "Utilize the facilities of government to promote research in the manufacture of synthetic liquid fuels, but without permitting governmental competition with private industry. Enact such legislation as may be necessary and proper to encourage secondary recovery from old fields which otherwise would not be productive.

3. "Encourage free competitive enterprise by tax reforms to restore the incentives for the risk of private capital in new ventures. Maintain the atmosphere in which competition may survive by enforcement of the antitrust laws. Adhere to the federal statute prohibiting shipments in interstate commerce of petroleum produced in violation of state law. Continue the provisions of the income-tax law permitting deductions for depletion and intangible drilling costs.

4. "Require full disclosures to the appropriate agency of government of the principal terms, conditions, and obligations by which American companies undertake to carry on the petroleum industry abroad.

5. "Follow a foreign policy designed to promote full development of the petroleum resources of the whole world for the benefit of all peoples of the world; to secure adequate supplies of petroleum to all peoples; and to discourage artificial restraints and restrictions, both political and private, which deny full opportunity for the people of all lands to participate beneficially in the production and distribution of petroleum and petroleum products."

Other suggestions are that Naval petroleum reserves, except the one in Alaska, be abandoned and opened to leasing like the rest of the public domain; that legislation be enacted to permit mineral leasing of scattered lands acquired by the federal Government and not now treated as part of the public domain; and that income and inheritance taxes be revised to encourage small companies to plow back their earnings and permit individual enterprises to continue after the death of the founder.

Much of the report is devoted to a brief factual summary of the American petroleum industry, our reserve position, relation with the rest of the world, and our past petroleum policies. The entire report is footnoted with reference to source material, particularly presentations made by the industry at the many hearings.

Regarding national defense, the committee said that this country "must develop a national petroleum policy which will make certain that we shall not become dependent upon any other country for our supply of liquid fuel. . . . In the final analysis the reserves within our borders are more likely than not to constitute

the citadel of our defense. It follows that nothing should be done to weaken the productive capacity of domestic reserves. . . . Crude reserves in the ground, no matter how vast, are useless in an emergency unless they are producible to meet the emergency."

Synthetic production is the answer to national defense and to fears that we are running out of oil, the committee says, pointing out that natural gas, shale, coal, and lignite are available in tremendous quantities and can be liquefied at costs not too far above that of refining crude petroleum. It recommends "bold steps" in the direction of synthetic production, hinting, without actually recommending, that imports of crude might be curtailed as a means of speeding the synthetic program.

The foreign operations of American oil companies are given a pretty clean bill of health by the committee, which points out that huge corporations are required for the job of investing capital and dealing with foreign governments. It views with alarm the growing trend toward nationalization and authoritarianism in the world and implies that American oil corporations are the chief outposts of the American system. Since oil operations abroad take on many of the attributes of government, the report favors strong diplomatic support for them but with the provision that these companies keep the government better informed of their dealings, contracts, and obligations, and that more care be taken to prevent the growth of cartels.

The big companies could flood the United States with foreign oil, it is admitted, but the report suggests that growing demands for petroleum products, both here and throughout the world, will minimize this danger to the domestic industry.

A section on "The Independent Company" declares that both the majors and the independents have a place in the industry and both should be preserved. It suggests a general government policy toward business such that independent operators can prosper and withstand the forces tending toward concentration of ownership.

Senator Moore's concurring report objected not to any statements in the report itself but rather to implications which might be read into certain parts of it.

He approved the requirement that corporations operating abroad inform the Government about their operations but warned against requiring disclosure of competitive trade secrets. He declared that a distinction should be preserved between application of the antitrust laws to domestic business and to foreign operations.

Endorsing encouragement to secondary-recovery operations, Moore warned against extension of the powers of the federal Government and specifically opposed any suggestion of a government subsidy for stripper wells or secondary-recovery projects.

Likewise on the matter of conservation, Moore urged that the federal Government's role be confined to research and cooperation with the industry, the state governments, and the Interstate Oil Compact Commission.

He also insisted that the Government refrain from competition with private enterprise, both domestically and in foreign operations. *(Comments on the committee's report will be found in Watching Washington, page 51.)*

I.P.A.A. Committee Recommends Sharp Cutback in Crude Production

THE executive committee of the Independent Petroleum Association of America meeting January 30-31 in Los Angeles received an estimate from its supply and demand committee of sharply reduced crude production requirements in the first half of 1947, and in another session was told by Walter S. Hallanan, chairman of the National Petroleum Council, that the council "stands as a barrier" against government regulation of the industry.

Hallanan, who is president of Plymouth Oil Co., Pittsburgh, spoke at a luncheon tendered the I.P.A.A. officials by a group of California oil men. The I.P.A.A. meetings were continuing this week with sessions scheduled February 4 at Bakersfield and February 5 at San Francisco.

"By our own neglect and indifference to the public welfare we can do more to jeopardize the freedom of our industry than all the followers of Karl Marx can do through all their devious and specious propaganda," Hallanan declared.

He asked for the industry's wholehearted support of the National Petroleum Council. "We have not been asked to surrender our freedom," he continued. "We are only asked to cooperate along lines that will aid in the elimination of governmental confusion, and in counseling with those charged with the responsibilities of national security. Those are requests which we should not and cannot deny.

"There are those in the petroleum industry who think only in terms of the tragedies of the Madison prosecutions," he said. "In a sense they cannot be blamed for their lack of confidence in the good faith of the Government. That was a grievous error upon the part of the Government that will take a long time to wipe out. But we are aware that governments represent the expressions of men, and governments err just as men err. . . . No new experiment in government-industry cooperation is completely free from some element of danger," he added. "It would be foolhardy for me to say that it was. Conversely, I am willing to say that I believe the danger of this experiment is quite negligible. I believe we are destined to fill a highly useful and patriotic function."

Estimated Domestic Demand

The forecast of petroleum supply and demand trends was made in a report by the association's supply and demand committee with Charles F. Roeser, Fort Worth, chairman, and H. B. Fall, Ardmore, Okla., vice chairman.

The required quantity of domestic crude petroleum was estimated at 4,415,000 bbl. daily for the first quarter and 4,540,000 bbl. for the second quarter. These estimates average about 4,480,000 for the 6-month period as compared with an actual output of 4,680,000 for the same period in 1946. To meet the total domestic and export demand, additional supplies were anticipated from the production of natural gasoline and benzol, from imports, and from stock withdrawals.

In explaining the need for lower crude production, the report pointed out that additions to petroleum storage during the past year totaled 49,000,000 bbl., at least half of which, it was stated, was unnecessary and wasteful. This oversupply was aggravated by an all-time record level of petroleum imports during the last half of 1946, according to the report. These record imports, it was stated, are interfering with the domestic conservation program and, if continued, will contribute directly to the elimination of the independent producer from the petroleum industry.

The report strongly urged that the Interstate Oil Compact Commission and the state regulatory agencies give prompt consideration to the necessity for reducing production within the limits of consumptive demand and avoiding wasteful stocks during the first half of 1947. The uneconomic effects of the unnecessary and wasteful stocks built up during 1946 would be multiplied, it was claimed, if a set-back in general business activity should occur before these stocks are reduced within proper working levels.

Louisiana Gas Still Moving East; State Denied Injunction

AT the rate of 50,000,000 cu. ft. a day, natural gas from Lucky field continued this week to flow to eastern states through the Big Inch pipe line after District Judge Robert J. O'Neal in Shreveport last week refused the State of Louisiana an injunction to prohibit its export by the H. L. Hunt interests.

Judge O'Neal dismissed the state's suit for an injunction, holding that there is no allowable order in force for the field and that without an allowable there "is no limit to the right to produce." J. R. Goff, attorney for Hunt, had contended that the 1940 gas conservation statute prohibits production only "in excess of an allowable."

In a verbal ruling, Judge O'Neal said the state had pleaded the Hunt operators were producing "illegal gas" but that Hunt had followed the wording of the act and the point made that without an allowable there could be no illegal gas was "well taken." The right of the state conservation commissioner to seek emergency action through injunctions to prevent waste is recognized, he said, but the state, he said, did not allege waste. Therefore, he declared, the state did not establish a cause for action and was not entitled to an injunction.

The injunction suit resulted from the discovery early in January that the state Conservation Department had granted the Hunt interests an allowable of 50,000,000 cu. ft. for the Lucky field wells. Later Conservation Commissioner Joseph L. McHugh revoked the permit, declaring it had been done without his knowledge and the export of natural gas was in conflict with the state's established policy of conserving its natural resources.

Hearing Set for Next Week

A hearing for a new allowable on the field has been set for February 10 in Baton Rouge at which the state Office of Natural Gas Conservation is expected to vigorously oppose the granting of any allowable which would permit export of gas. Under a statement of policy, the Conservation Department considers as waste the export of natural gas to areas considered to be well supplied with other fuels for industrial purposes.

Ruling of Judge O'Neal that no allowable was in force in Lucky field conflicted with an opinion handed down recently through the state attorney general's office holding that the state conservation commissioner had no authority to withdraw or revoke the 50,000,000 cu. ft. allowable.

Tennessee Gas & Transmission Co., operator of the Little Big Inch line, filed a separate answer to the state's charges, declaring the granting of an injunction would make more dangerous an eastern fuel shortage and "imperil the health, comfort, and welfare of thousands of people who use gas in their homes . . . and will halt or curtail many industries . . ."

The day before the injunction suit was heard, former Gov. Sam Jones, in a speech in St. Martinville, declared Louisiana's gas "is needed as a fuel to industrialize the state" and asserted the "destiny of any section" depends largely upon its resources. The state's natural gas, he said, "must be preserved."

Jones was answered in an address in Shreveport by state Rep. William J. Dodd, who declared there is "no logic" in a policy "which encourages the development of mineral resources and then tells our citizens they cannot sell those minerals on the open market." The state, he said, has "no monopoly on gas and oil" and is "foolishly" losing its markets to Texas, Oklahoma and other states.

Louisiana's official policy of opposition to the movement of natural gas out of the state also was condemned by a group of land and royalty owners who met at Arcadia and organized the North Louisiana Natural Resources Development Association. The group passed a resolution declaring the state's antiexport policy to be "unjust and unwise."

Deadline to Halt Big Inch Sale Passes

WASHINGTON. — War Assets Administration apparently is free to proceed with its plans for opening bids February 10 for sale of the two Big Inch pipe lines for either oil or gas use.

February 3 was the last day of the 30-day period Congress allowed itself, under the Surplus Property Act, to vote disapproval of WAA sales programs, since on January 3 Administrator Robert M. Littlejohn filed his report outlining Big Inch disposal plans. On the final day the Senate armed forces committee heard WAA officials in executive session and then announced that it would not reverse its original decision not to report out a resolution postponing WAA action.

Likewise the House committee on interstate and foreign commerce took no action on similar resolutions pending before it, and both House and Senate adjourned until February 5. WAA officials were prepared to hold up sale of the lines for a reasonable period if either House or Senate so voted, even though action of both within the 30-day period is required to make the action legally binding, and the agency probably would have done the same thing if either committee had reported a postponement resolution. Even though the official deadline has passed it would still be possible for Congress to stop the sale at any time prior to actual award of a contract. But such action is very improbable.

FPC Revises Big Inch Allocations

WASHINGTON.—A new allocation of natural gas moving through the Big Inch system was promulgated by the Federal Power Commission February 4 whereby Consolidated Natural Gas Co. gets more gas for its subsidiary, East Ohio Gas Co., chiefly at the expense of Columbia Gas & Electric Corp. and Equitable Gas Co. systems.

This action was taken because of the urgent request of East Ohio for more supplies due to extreme low temperatures in its area, despite an adverse report from FPC's Big Inch advisory committee.

The new schedule is 20,000,000 cu. ft. daily to Panhandle Eastern Pipe Line Co., 1,500,000 cu. ft. each to Louisville Gas & Electric Co. and Carnegie Natural Gas Co., and the balance, 47 per cent, to Columbia, 33 per cent to Consolidated, 10 per cent to National, and 10 per cent to Equitable.

The advisory committee urged that a technical committee be created to assist Tennessee Gas & Transmission Co., operators of the line, in preventing formation of hydrates during cold weather so that line pressure can be increased and capacity raised above 100,000,000 cu. ft. per day.

_____this week

GOVERNMENT—Long-awaited report of Senate petroleum-resources committee released by Chairman O'Mahoney. . . . Findings generally give the industry a clean bill of health. . . . Necessity of maintaining strong domestic industry together with traditional system of free enterprise emphasized in report. . . . Recommendations include encouragement of exploration and development, promotion of interstate compacts, higher degree of conservation, research in synthetic-fuel manufacture without competing with private industry, tax reforms, enforcement of antitrust laws, adherence to Connally Hot-Oil Act, and continuation of depletion and drilling-cost deductions. . . . Report outlines the broad considerations of a national oil policy. . . . Senator Moore's supplemental report amplifies his own views on several specific points. . . .

FORECASTS—I.P.A.A.'s supply and demand committee in a report to the association's executive committee in Los Angeles declares reduction in crude production through first half of 1947 necessary to avoid wasteful stocks. . . . Group recommends average output in first half of 4,480,000 bbl. daily, as compared to 4,680,000 in the same period of 1946. . . . ¶Bureau of Mines estimates February demand at 4,640,000 bbl. daily—the same as January but 140,000 bbl. daily below December. . . .

REFINING—Texas Co. says its new Philadelphia area refinery will be located at Eagle Point, Gloucester County, New Jersey, 5 miles downstream from the Philadelphia-Camden bridge. . . . First unit to have capacity of 40,000 bbl. daily. . . . ¶California Standard's subsidiary, California Asphalt, opens new asphalt refinery at Willbridge, Ore. . . .

BIG INCH—Congressional committees fail to act on resolutions to halt February 10 sale of Big Inch lines. . . . February 3 deadline for congressional intervention passes. . . . WAA apparently free to proceed with disposal. . . . ¶FPC reallocates distribution of natural gas being received through Big Inch system under Tennessee Gas & Transmission's interim lease. . . . East Ohio Gas given more gas in view of low temperatures in its service area. . . . ¶Louisiana conservation officials denied injunction to halt movement of 50,000,000 cu. ft. daily into Big Inch lines. . . .

INTERNATIONAL—Creole's December output drops to 529,166 bbl. daily as a result of tanker-transportation shortage. . . . ¶Argentine Government group visiting United States to arrange equipment for the construction of a 1,100-mile natural-gas pipe line from Comodoro Rivadavia to Buenos Aires. . . . ¶Commonwealth Oil Refineries, Ltd., resumes operations at its Laverton, Victoria, refinery, with arrival of shipload of Iranian crude. . . .

NATURAL GAS—FPC approves $23,494,000 construction program of Natural Gas Pipeline Co. of America and Texoma Natural Gas. . . . Work to be completed early in 1949 to give Natural Gas Pipeline a capacity of about 484,000,000 cu. ft. daily. . . . ¶Michigan-Consolidated Gas awards contract for L.P.G. standby facilities in Detroit which, with existing equipment, is expected to be the world's largest storage plant for L.P.G. . . .

EXPLORATION—Superior Oil Co. establishes new world depth record in Oklahoma. . . . Caddo County wildcat now drilling ahead below 16,668 ft. . . . ¶New deep pay zone found on Kettleman Hills Middle Dome in Kings County, California. . . . Standard of California's discovery gets first commercial production on Middle Dome in several years. . . . ¶New shallow production found in Matagorda Bay, Calhoun County, Texas. . . . Offshore discovery by The Texas Co. indicates potentialities of Gulf of Mexico drilling. . . .

Railroads at present are the nation's biggest industrial users of coal but indicative of the reversed trend is the fact that today 95 per cent of all new locomotive orders are for diesel-electric engines. To keep pace with the changeover to oil, the petroleum industry is conducting extensive research to improve diesel fuels and lubricants. Already nearly 2 years old is this traveling laboratory of Standard Oil Development Co., installed in a diesel freight locomotive of New York, Ontario & Western Railway. Picture at left shows Dr. Leonard Moody, oil-company research chemist, climbing aboard. At right, Moody and Earl W. Ball, lubrication engineer, check the log with the fireman and engineer in the locomotive cab. At frequent intervals, lubricating-oil samples from the locomotive's crankcases are tested

West Edmond Unitization Application Filed; Hearing Scheduled for March 18

by E. G. Dahlgren

AN application for unit operation of the Hunton lime zone of the four-county West Edmond oil field near Oklahoma City was filed with the Oklahoma Corporation Commission January 29. Hearing on the application was set for March 18.

The application was signed by operators controlling over 60 per cent of the proved acreage in the pool. The following operators have signed the application: Stanolind Oil & Gas Co., Sohio Petroleum Co., Anderson-Prichard Oil Corp., Phillips Petroleum Co., Deep Rock Oil Corp., Tide Water Associated Oil Co., Allied Oil Co., Atlantic Refining Co., Mid-Continent Petroleum Corp., H. J. Schmitz, Skelly Oil Co., L. A. Chudacoff, Magnolia Petroleum Co., Sunray Oil Corp., and Cities Service Oil Co. It is understood that practically all of the other operators intend to support the application.

The application was filed under provisions of House Bill 339, passed in 1945 by the Oklahoma Legislature. The unitization plan covers 29,640 acres on which there are 737 producing oil wells for the largest field in the nation ever attempted to be unitized. The field, discovered in April 1943 has produced approximately 58,000,000 bbl. to January 1, 1947. The Hunton lime formation is found at subsurface depths ranging from 6,600 ft. on the east side of the field to 7,100 ft. on the west side.

The West Edmond application is the second filed with the Corporation Commission under HB 339 that has met the requirement of at least 50 per cent of the working interests for consideration. The first involved the Medrano sand in Cement field. The application states that unitized methods of operation are necessary to utilize all gas production and to recover more oil.

Details of Plan

The detailed plan of unitization attached to the application covers nearly 80 pages with a map of the proposed unitized area. Sohio, one of the largest operators in the field, is named unit operator. Adoption of the unit plan would enable the area to be operated as one lease with all production divided and allocated to each tract in accordance with the percentage of interest in the unit.

An operating committee, consisting of one representative designated by each lessee or operator, is proposed for the general over-all management and control of the unit. This committee will have the power to remove the unit operator and select a successor. It will determine the extent of drilling operations and development to be carried on by the unit operator. The committee also will determine the best manner of gas injection. The committee will select subcommittees, such as executive, advisory, engineering, plant, geological, tax, and legal. Each lessee or operator shall have a vote proportional to his interest.

If the application is granted, the operating committee will be organized to make preparations for the taking over of the unitized operations and further development of the unit area. The application contemplates the changeover to take place between 61 days and 3 months after the order is granted.

The salt-water disposal system of the West Edmond Salt Water Disposal Association is slated to be taken over by the unit.

Regulation of Production

As soon as possible after the effective date of the unitization of the field, four pilot or experimental gas-injection projects will be started to determine the proper conditions and the location or locations for gas injection to obtain the greatest quantities of oil. Production will be regulated from wells making water or excessive amounts of gas for the most efficient operation of the field.

Studies conducted by the engineering-geological subcommittee of the West Edmond Operators Committee resulted in the conclusion that the field, which produces without an adequate natural water drive, originally contained approximately 600,000,000 bbl. of oil. Of this amount 140,000,000 bbl. can be removed under present methods of operations.

With unitization using production practices conserving the energy in the reservoir, more oil can be produced. If the unitization program is started, high gas-oil ratio wells will be shut in, and production increased from low-ratio wells with the result that the present large gas production will be reduced without decreasing the oil production. By producing the allowable oil production of the field from selected wells, engineers and geologists believe an additional 10,000,000 bbl. of oil can be produced.

The pilot or experimental gas-injection program, costing nearly $500,000, will use about 20,000,000 cu. ft. of gas per day. If the experimental program is successful, the majority of the engineers and geologists believe a field-wide gas-injection program, controlled satisfactorily, will increase ultimate oil production of the field from 140,000,000 bbl. to 180,000,000 bbl. Some engineers and geologists believe this 40,000,000 bbl. increase is a conservative estimate and that gas injection may result in as much as 80,000,000 bbl. additional recovery.

Adoption of the unitization program will prolong the economic life of the field. It has been estimated that without unitization approximately 25 per cent of the wells in the field will have been abandoned by 1952 and the balance producing on the pump. By 1957 these wells will have been plugged and abandoned. With unitization, the producing life may be extended to 1959 or longer. With a gas-injection program, the field may be produced to 1965 or longer.

More than 3,500 royalty owners have been informed regarding the unitization plans. Last December 18, a meeting for all royalty owners was held in the Deer Creek School in West Edmond field. Representatives of the operators explained the plan and answered questions. Various meetings have been held by the royalty owners. These meetings have demonstrated a keen interest in conservation and the problems of the operators.

It is interesting to note that the formula, by which participation of each well is determined, involves the current allowable of the well, bottom-hole pressure, and thickness of the producing formation. The allowable used in the formula is that assigned by the Corporation Commission. The commission assigns an allowable which is subject to a limiting gas-oil ratio factor. Bottom-hole pressure was determined in the last field-wide survey in September 1946. Thickness of the producing forma-

(Continued on page 126)

Western Oklahoma Test Sets New Depth Record

A NEW world's drilling-depth record was set in Caddo County, Oklahoma, February 3 when Superior Oil Co. resumed drilling on its 51-11 Weller, NW NW NE 11-8n-12w.

The company halted drilling at 16,668 ft. the morning of February 3 and measured the hole "to the inch" to prove it had tied the depth of Pacific Western Oil Corp. 1 National Royalties in Kern County, California. The California well is now involved in a fishing job but will resume drilling if the hole is cleared.

The Oklahoma well, started May 1946, has been shut down only once to strengthen the derrick. It is being drilled by company tools under the supervision of Lamon Corley, Fort Cobb, Oklahoma, and John Cody, Los Angeles. It also has set a new record for the longest string of pipe ever set by running 7-in. casing to 16,351 ft. Other casing in the hole consists of surface pipe set at 1,540 ft. and 9-in. at 10,240 ft.

Superior started the wildcat in what was believed to be the deepest part of the Anadarko basin to determine the possibilities of oil-bearing zones in that section. It originally was announced the well would be drilled to the basement, expected between 17,000 and 20,000 ft., provided equipment were capable. The company is withholding geological information, but it is believed that some indications of oil or gas have been encountered.

Inventory of Mineral Resources Requested

WASHINGTON.—A detailed survey of the nation's mineral reserves, which might take as long as 20 years and cost $1,000,000,000, is proposed in the annual report of the Department of the Interior, submitted to Congress by Sec. J. A. Krug.

Major proposals contained in the report included: promotion of federal-state-industry efforts to reduce waste of natural gas; continuation of the development of synthetic liquid-fuel production methods to augment natural supplies of petroleum; continued supervision over mineral production on public lands; and management of all minerals in all federal lands through the minerals agencies of the Interior Department, rather than through several departments.

The Bureau of Mines report, pointing out that domestic crude production is now at about maximum efficiency, predicted the cost of producing gasoline from coal or oil shale on a commercial basis within the next few years will be between 7½ and 9½ cents a gallon.

West Texas Survey Planned

AUSTIN.—Dr. S. S. Goldich, head of the Bureau of Economic Geology, University of Texas, has announced an extensive program of geological surveying and fundamental research of the trans-Pecos area of West Texas. The long-range program will complete geological mapping of the region. Special attention will be given to the Jordan Gap, Tascotal Mesa and Christmas Mountains area in Brewster and Presidio counties.

Geological Societies Elect New Officers

New officers of the Society of Economic Paleontologists and Mineralogists are, left to right: James A. Waters, Sun Oil Co., Dallas, president; William C. Krumbein, Northwestern University, Evanston, Ill., vice president; and Henry B. Stenzel, University of Texas, Austin, secretary-treasurer

New officers of the American Association of Petroleum Geologists, elected in the organization's first mail-ballot election, are shown above. Left to right are: C. E. Dobbin, U.S.G.S., Denver, president; George S. Buchanan, Sohio Petroleum Co., Houston, vice president; J. V. Howell, consultant, Tulsa, secretary-treasurer; and C. L. Moody, Ohio Oil Co., Shreveport, editor. They will take office, along with new officers of the Society of Economic Paleontologists and Mineralogists, following the petroleum geologists' annual convention, to be held jointly with S.E.P.M. in Los Angeles March 24-27

International

WORLD-WIDE OIL DEVELOPMENTS

Argentina Seeking Pipe for 1,100-Mile Gas Line

A COMMISSION of the Argentine Government is now in the United States for the purpose of studying advances in the design and construction of gas pipe lines and to buy equipment for the early construction of a 1,100-mile 10¾-in. gas pipe line from Comodoro Rivadavia fields to Buenos Aires for which $25,000,000, U. S., has been appropriated. This will be an undertaking of an organization known as Argentine States Gas Service Department (Direccion General del Gas del Estado, Secretaria de Industria y Comercio). The commission is headed by Teofilo M. Tabanera, engineer, who is chairman; he is accompanied by Juan B. Siri, engineer, and Abel O. Malvestiti, assistant business agent.

T. M. TABANERA

Consideration is being given to operation at 1,000 psi. but plans may be modified. Since the commission has not yet obtained the pipe, the number of stations and final decision in regard to operating pressures and the number of stations and the types of compressor-plant equipment will be determined after all factors of the problem have been studied. The commission also intends to contact organizations for contracting the design and construction of plants and lines.

While Tabanera is in California for the first 10 days of February, Siri will be contacting contracting and equipment firms in Tulsa. Tabanera will return to Tulsa for a week before going with the commission to Pittsburgh and New York. If it is not possible to procure pipe and other equipment from United States sources for early construction, the commission will go to Europe to investigate the possibilities of procuring them from manufacturers in England, Belgium, Switzerland, France, and Italy.

According to present plans, it is highly desirable to purchase equipment and contract for the construction of the entire project so that work would start in the first half of this year and be carried on for early completion.

The gas-line project is being planned for an initial daily throughput of 600,000 cu. m. (21,000,000 cu. ft.). Reserves of the Comodoro Rivadavia fields are estimated to range from 14 to 25 billion cubic meters (490 to 875 billion cubic feet).

In Argentina there is a 40-mile 3-in. natural-gas line from Tupunga field to the city of Mendoza. For the last 18 months a 40-mile 6-in. line has been transmitting 70,000 cu. m. (2,450,000 cu. ft.) daily at 300 psi. from the La Plata refinery to Buenos Aires.

Argentina States Gas Service is utilizing this La Plata gas in connection with the operation of a manufactured-gas plant and distributing system acquired from British interests. Under government operation rates have been reduced from 37 centavos per cubic meter to 27 centavos ($1.89 per M.c.f.). After it becomes possible to obtain sufficient gas through the proposed pipe line, it is expected that further reductions will be made in the price of gas.

Sweden Shifting to Oil Economy, Egloff Tells Tulsa Nomads

SWEDEN'S rapid shift to a postwar oil economy and its efforts to produce indigenous substitute fuels during the war were described by Dr. Gustav Egloff, director of research of Universal Oil Products Co., Chicago, at the Tulsa Nomads annual dinner January 31.

S. W. WILCOX

Reporting on observations and studies made during his trip to England and the Scandinavian countries last year, Egloff told the Nomads and their guests that Sweden today is "alive to the advantages of using petroleum products" and will undoubtedly head toward a resumption of petroleum imports greater in volume than prewar.

Another feature of the meeting was the installation of Stanley W. Wilcox, director of public relations and advertising for Seismograph Service Corp. as president of the Tulsa Nomads. Wilcox was elected by a mail ballot to succeed Henry A. Bourne, Republic Steel Corp.

Other officers installed at the meeting were: Earle E. Smith, National Tube Co., vice president; Anthony Gibbons, Gulf Publishing Co., secretary; Fred A. Karns, International Service Co., assistant secretary; Kenneth O. Hoevel, National Supply Co., treasurer; Charles E. Duller, Wells Surveys, Inc., assistant treasurer; L. S. Reagan, Webster Engineering Co., sergeant-at-arms; B. E. Groenewold, Bethlehem Supply Co., deputy sergeant-at-arms; and Shep Miers, Southwest Supply Co., and Bourne, regents.

In his discussion of "Fuels Used in Sweden," Egloff pointed out that Sweden consumed only 1,500,000 bbl. of fuel oil in domestic heating and industry before the war. It is now estimated, he said, that 3,225,000 bbl. were consumed in 1946. The Swedish

Government, he added, is aiding in the conversion to oil by providing equipment priorities.

With crude oil again available, the A. Johnson & Co. refinery near Stockholm is again in operation, Egloff said. During the war, this refinery operated on shale oil, wood tars, and redistillation of oil products and also produced various chemical products. A large-scale new refinery is being built at Gothenburg in addition to Johnson & Co.'s Malmo refinery.

"Sweden is now rapidly converting to a postwar oil economy," Egloff told the Nomads. "Her fuel requirements are increasingly being met by imports of petroleum and petroleum products since the prospects of increased imports of coal are poor. . . . Many Swedish industries are making provision for changing from wood and coal to fuel oil, particularly cement works, pulp mills, and power stations, and it is felt that many other industries will adopt oil fuel."

Coal Imports Dropped During War

During the war Sweden's normal coal imports, principally from England, began to drop, and the country was forced back on its own natural resources consisting of wood, peat bogs, coal, and oil shale. Because of the gasoline shortage common throughout Europe, Sweden early resorted to the use of producer-gas driven engines, and was able to supply both wood and charcoal as fuel for the generators. In 1942, the demands of producer-gas engines were 88,000,000 cu. ft. of charcoal and 71,000,000 cu. ft. of wood.

Swedish Engineers Praised

Swedish engineers, Egloff continued, showed a high degree of mechanical skill in adapting motor-driven vehicles to the use of producer gas. Use of these engines increased so rapidly that Swedish officials began to feel alarmed over the dwindling wood resources. Charcoal, more compact and convenient, was preferred but it required twice as much wood.

Sweden is continuing the government-conducted work in shale-oil production in the expectation that by-products, such as high-grade sulfur, and aluminum, vanadium, molybdenum, and uranium oxides in the spent shale, will make the processes economical. Yields of oil from the large shale deposits in Sweden are from 5 to 6 per cent, but the country's total resources are large. The Kvarntorp shale-oil refinery was built in 1942 at a cost of about $20,000,000, Eglcff said, and is now planned to enlarge the capacity to 800,000 bbl. annually by improving the productivity of the oil-shale retorts.

Tanker Shortage Again Reduces Creole's Output

NEW YORK. — World-wide tanker shortage has again resulted in a drop in Creole Petroleum Corp.'s Venezuelan daily average crude-oil output. The December daily average was 529,166 bbl. compared with 575,351 bbl. for November and 585,684 bbl. for October.

The tanker shortage also resulted in reduced crude runs which dropped to 51,552 bbl. in December compared with 73,651 bbl. in November. Of the December daily average, 41,173 bbl. were refined at Caripito and 10,379 bbl. at La Salina.

Two Holes Dry

December's daily crude production shows that 381,019 bbl. came from Lake Maracaibo area and Cumarebo and 148,147 bbl. from eastern Venezuela.

Two wildcats were brought in, one in the Jusepin area field, the other at Mulata. The Jusepin well, drilled to 6,945 ft., showed an average initial production of 244 bbl. The Mulata well went to 7,731 ft. and flowed at 334 bbl. Two dry holes were reported (wells JX-2 and JGE-28) in Jusepin and in Mulata.

Twenty-two development oil wells were brought in by Creole. No gas wells were completed. The fields where these wells came in, their average initial production, and depth follow:

Bolivar Coastal (B.C.F.), ten, 1,179 bbl., 3,719 ft.; Jusepin, seven, 380 bbl., 4,290 ft.; Quiriquire, three, 574 bbl., 4,677 ft.; and Mulata, two, 536 bbl., 5,175 ft.

Chinese Technical Training Work Given Recognition

NEW YORK.—Nine oil companies were among the 102 major American industrial organizations that gave on-the-job training to Chinese technicians during the war, and for which they have received formal recognition and the personal gratitude of Generalissimo Chiang Kai-shek.

The oil companies are: Humble Oil & Refining Co.; Shell Union Oil Corp.; Socony-Vacuum Oil Co., Inc.; Standard Oil Co. of California; Standard Oil Co. of Indiana; Standard Oil Co. (N. J.); Standard-Vacuum Oil Co.; Sun Oil Co., and The Texas Co.

Among the other recipients were the Lummus Co., Union Carbide & Carbon Corp.; U. S. Rubber Co.; Worthington Pump & Machinery Co.; and Sun Shipbuilding & Dry Dock Co.

Chiang Kai-shek's message, in part, read: "Now that the wartime training

program has come to an end, I most sincerely hope that some means may be found to continue this important work. China is in desperate need of men and women trained in modern technological methods and we look to America to aid us as we face the critical years ahead.'

Dr. V. K. Wellington Koo, Chinese ambassador, explained that "we have long realized that to build up a modern China and raise the standard of living of the Chinese people it is absolutely necessary to carry out a comprehensive program of industrialization. For this purpose, capital and raw materials are of course indispensable, but, above all, trained personnel is a primary need."

Arabian American Expansion Forecast

OIL production in Saudi Arabia is limited at present only by the limitations imposed by facilities available for its transportation, according to statements made by James MacPherson, resident vice president of Arabian American Oil Co., in Dhahran, Saudi Arabia.

With construction of the proposed trans-Arabian pipe line, not yet in the blueprint stage, the company hopes to see a daily production of 500,000 bbl., MacPherson said. Production now averages more than 200,000 bbl. daily from 44 producing wells in four fields, covering only a small fraction of the company's concession. The proposed line would move more than 300,000 bbl. daily.

Since 1933, more than $200,000,000 has been spent in developing the Arabian oil fields, well above the value of the oil taken out to date. But company officials expect a much greater investment following agreements between Standard Oil Co. (N. J.) and Socony-Vacuum Oil Co. and the original parent companies, The Texas Co. and Standard Oil Co. of California.

At present, plans are being made to spend between $60,000,000 and $80,000,000 within the next 18 months. Included in the projects would be construction of 550 more housing units for employes, paving of 150 miles of road, and construction of a vast tank farm.

New wells being drilled this year, officials believe, will more than meet the company's commitments and provide sufficient production to more than fill the proposed line to the Mediterranean.

Three Companies Press Widespread Search for Oil in Egypt

by Warren W. Burns

THE three major oil companies operating in Egypt are currently engaged in intensified exploration activities in the hope of finding fields comparable in reserves to those which lie across Arabia in the Persian Gulf area.

Indicative of the determination of the companies to continue the search for oil in northern Egypt is the fact that they have provided thousands of dollars in their 1947 budgets to assist in clearing and exploding land mines planted in the area during the war by both Allied and Axis forces.

While exploration work and shallow drilling in Egypt date back as far as 1885, only three fields of commercial importance have been found in the country. Most important of these is Ras Gharib but with original reserves of only about 100,000,000 bbl., it ranks as relatively insignificant when compared with the prolific major producing areas in the Persian Gulf.

A substantial oil discovery in Egypt would be worth more, barrel for barrel, than those in the Persian Gulf. Northern Egypt borders the Mediterranean Sea and is considerably closer to the markets of Europe, second in world importance only to the United States. At present, most Middle East production is brought to the Mediterranean by tanker or pipe line.

The three companies operating in Egypt consist of one British-Dutch company, Anglo-Egyptian Oilfields, Ltd., unit in the Royal Dutch-Shell group, and two American companies, Standard Oil Co. of Egypt, S.A., a subsidiary of Standard Oil Co. (N.J.) and Socony-Vacuum Oil Co., Inc. Exploratory blocks held by these three companies are scattered through northern Egypt from the Libyan to the Palestine borders.

A fourth company formerly operating in the area was South Mediterranean Oilfields, Ltd., a subsidiary of Cal-Tex Co. (Standard Oil Co. of California and The Texas Co.) In the spring of 1945, this company announced it was discontinuing its Egyptian operations and that its properties would be taken over by the other three companies. The decision came after the completion of a dry hole 25 miles northwest of Cairo.

Of the three remaining major companies, Anglo-Egyptian Oilfields has all of Egypt's present production—some 25,000 bbl. daily. Of this, 24,000 bbl. daily comes from Ras Gharib, and 1,000 bbl. daily from Hurghada field.

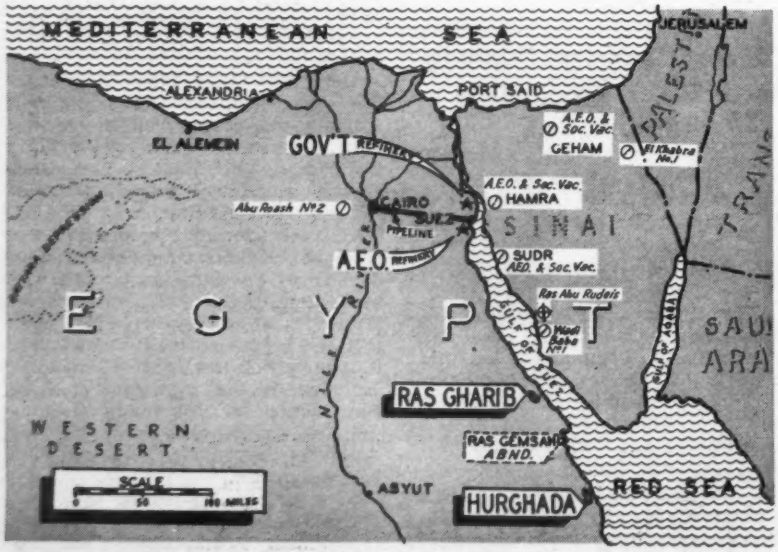
Both fields are on the west side of the Gulf of Suez. Accumulative production of Ras Gharib is about 55,000,000 bbl. The field was discovered in 1938 and by 1940, its output had been expanded to 20,000 bbl. daily. During the war, to meet demands of the Allied forces, particularly during the Lybian campaigns, production was further stepped up. Twenty-five of its wells are flowing; 13 others are gas lift; a number of others are pumping.

Located on a barren stretch of desert, Ras Gharib produces 25°-26°-gravity oil from basal Miocene limestone and pre-Miocene sands at depths from 1,500 to 2,400 ft. The field is an easterly dipping monocline of pre-Miocene age truncated to the west and south by a series of faults. The formations are overlain unconformably by a domal mantle of Miocene beds with the main fault system partially reflected in that series.

South of Ras Gharib, below the point where the Gulf of Suez meets the Red Sea, and about 200 miles south of Suez, is Hurghada field. Production was first found here in 1913. Accumulative output is about 40,000,000 bbl., and the field is on the decline. Its peak production came in 1931 when output for the year was 1,800,000 bbl.

All 62 of the Hurghada field wells are now on the pump. Production comes from Nubian sand formations lying unconformably below the Miocene at depths ranging from 1,700 to 2,200 ft. A total of 135 wells have been drilled in the field but many were plugged as production dropped. Gravity of the oil ranges from 22° to 24°.

Oil from both Ras Gharib and Hurghada is shipped by tanker to the refinery operated by Anglo-Egyptian Oilfields at Suez. This plant has a capacity of 35,000 bbl. daily crude and 4,000 bbl. daily cracking. The Egyptian Government also operates a small refinery of 1,750 bbl. crude capacity at Suez, using royalty oil supplied by Anglo-Egyptian Oilfields. During the war, on behalf of the British Army, the Shell interests built



This map of northern Egypt shows the location of recent exploratory tests, present producing areas, and the two Suez refineries

a 75-mile pipe line from Suez to Cairo.

Egypt's first production was found in 1908 in the Gemsah field which also is located on the western shore of the Gulf of Suez about midway between Ras Gharib and Hurghada. Before operations were suspended in 1927, the field had produced 1,418,000 bbl. Of the 22 wells drilled, 10 were producers from basal Miocene limestone at depths ranging from 1,240 to 1,310 ft.

The end of the war brought a wholesale resumption of exploratory activity in Egypt by the three companies involved. As of last July, the companies held a total of 718 exploration permits from the government, each covering an area of 100 sq. km. (24,711 acres).

These permits were distributed as follows: 176 permits issued and 25 pending for Sinai; 72 issued and 22 pending for the Eastern Desert; and 424 issued and 19 pending for the Western Desert. The distribution of the permits illustrates the extent of the interest in the Western Desert—the area west of the Nile River.

First success in the postwar exploration campaign came last year when Anglo Egyptian Oilfields, in partnership with Socony-Vacuum, brought in the SUDR wildcat on the east coast of the Sinai Peninsula for an indicated daily production of 275 bbl. of 22°-gravity crude oil daily. An official of Anglo-Egyptian Oilfields said a field of considerable commercial importance will be developed as a result of the successful completion and other geological findings. The area is being developed on an equal basis by the two companies.

The oil was found at the base of the Miocene in a sandstone reservoir at a depth of between 2,675 and 2,826 ft. The crude is reported to be rather sweet, comparatively rich in kerosene, poor in gasoline, and with a high percentage of asphalt. The well was located on the basis of gravimetric work, although there is also a surface structure in the outcropping Miocene. Ras SUDR 2 was scheduled to investigate the possibility of deeper producing horizons.

Other activity on the Sinai Peninsula includes the wildcat being drilled by Jersey Standard at Ras Abu Rudeis, located about 5½ miles due west of Wadi Baba where a test was abandoned at 4,538 ft. in hard dark gray to greenish gray mica schist. The Wadi Baba rig is being used on the Ras Abu Rudeis wildcat, which, late in December, was down to 6,425 ft. in the Miocene. Diesel-powered rigs are being used on these tests.

Sand and gravel add to the difficulties of oil exploration activities in the Western Desert of Egypt. In drilling the Abu Roash test west of Cairo, trucks with material encountered open desert the last 4 miles of the trip to the well site. Trucks frequently stuck in the sand, necessitating digging the wheels out as this crew is doing

The Socony-Vacuum-Anglo-Egyptian partnership also is drilling at Hamra, 20 miles northeast of Suez. In December, Socony-Vacuum moved two more rigs into the area east of Suez and hopes to have them in operation soon.

In northern Sinai, Egyptian Standard's 1 El Khabra, about 6 miles from the Palestine border and 25 miles from the seacoast, is the first test drilled in northeastern section of Sinai. In September, this test was drilled at 5,890 ft. in fossiliferous limestone, and late in December, was down to 9,981 ft. in shale and sand.

Geologically, the north Sinai section represents the southwestern continuation of the Syrian-Palestine belt. It is characterized by development of Jurassic strata and huge asymmetric anticlinal uplifts. Drilling in the area follows exploration work based on gravity meter and seismograph surveys.

This is in contrast to the stretch along the western side of the Gulf of Suez and the Red Sea where seismograph surveys appear to be of little value. Geophysical work here has been with the gravimeter, which confirmed torsion-balance work credited with the discovery of Ras Gharib field.

The Gulf of Suez and Red Sea area is a classical zone of subsidence. During the Miocene period, the sea ingressed a newly formed depression and laid down heavy saline deposits. The structures of the gulf are due to tension and have a very typical aspect. They are asymmetrical fault-blocks usually with a long gentle flank on one side and down-faulted zone of regional subsidence on the other side.

Most of the exploration permits are in the Western Desert area. Greatly increased exploratory activity is slated in 1947 and later when the mines have been cleared from this area.

Little drilling has been done in the Western Desert. Of the few tests, the most spectacular was Abu Roash, drilled 4 miles west of the famous Egyptian Pyramids. The test struck granite last October at 6,250 ft., and reached a total depth of 6,289 ft.

Egyptian Standard officials termed the well "a crucial test to determine whether oil might be found in this vicinity." The company is now drilling 2 Abu Roash which late in October was down to 2,430 ft. in limestone. The area of these tests is within 4 miles of the street-car lines to Cairo.

Egyptian Standard holds nearly 6,000,000 acres on exploration permit from the government, most of it in the Western Desert.

The Western Desert area has large exposure of Oligocene, Miocene, and Pliocene strata. Near the Pyramids where the present test drilling is taking place, there is a large outcropping of the lower Eocene and upper Cretaceous. Cretaceous Nubian beds also outcrop in this general area. In the desert, large areas are hidden below alluvial and wind-blown deposits making geophysical methods necessary to obtain information on the tectonic possibilities.

Kansas Association Recommends Bill for 25-Bbl. Minimum

THE Kansas Oil and Gas Association at its ninth annual meeting in Wichita last week went on record in favor of legislation increasing the state's minimum well allowable to 25 bbl. daily.

The second principal point in the association's program is legislation limiting allocations of acreage as between pools to 20 acres. The program was adopted on recommendation of a special committee and will be advanced on by another committee to be named later. The committee also will deal with the questions of a severance tax and a tax on nonproducing royalty.

Contentions of the Kansas Corporation Commission that it is without authority to fix a minimum well allowable higher than 15 bbl. daily were voided earlier by a decision of the State Supreme Court in a suit brought by a group of operators. The minimum has remained at 20 bbl. pending outcome of the litigation. A bill to fix the 25-bbl. minimum is scheduled to be introduced soon.

Lloyd R. Pickrell, Wichita, general manager of T. C. Johnson Estate and a partner in Biddle Drilling Co., was

L. R. PICKRELL

elected president of the organization. Other officers elected at the meeting were A. Leon Derby, Wichita, secretary-treasurer; E. B. Shawver and J. B. Hinkle, Wichita; John Denman, Sedan; and Orlin G. Stearns, Russell, vice presidents.

Elected to 2-year terms as directors were C. E. Ash, George H. Bruce, James Davis, Jr., Ward McGinnis, Ralph Nicholson, Perry Thayer, J. A. Aylward, A. S. Ritchie, Ralph Pryor, A. F. Brann, W. J. Coppinger, George E. Reeves, George B. Collins, E. C. Moncrief, Jack H. Heathman, Gail Carpenter, Marvin Wallace, Ed Adair, J. V. McKay, H. C. Bennett, Robert L. Williams, and Pickrell.

E. B. Shawver, one of the newly elected vice presidents of the association, was presented a plaque at the meeting in recognition of his efforts for independent oil men and the industry in general.

Barber Acquires American Republics Interest

OFFICIALS of Barber Asphalt Corp. and American Republics Corp. are discussing the possibility of a "close association" following the purchase by Barber Asphalt of 120,000 shares of American Republics' stock.

This has been disclosed in New York by T. Rieber, Barber Asphalt president. Last August, Barber Asphalt was disclosed to have sold its Venezuelan royalties, most of which were in Mene Grande field, to Shell Petroleum Corp., Ltd., for a reported $25,000,000.

American Republics, which at the end of 1945, had 1,300,000 shares of stock outstanding, had in 1945 a daily average crude production of 5,012 bbl., including natural gasoline. The company operates a 6,500-bbl. capacity skimming plant at Houston and a natural-gasoline plant of 24,000-gal. daily capacity in Tyler County, Texas.

Wholly owned subsidiaries of American Republics are American Petroleum Co., which operates pipe lines in Louisiana and Texas; Republic Production Co., which has mineral land titles in Texas; Petroleum Building Co., which operates a 21-story office building in Houston; and Pennsylvania Shipyards, Inc., at Beaumont, Tex.

Barber's principal assets include a lease of Pitch Lake, Trinidad, and facilities there for the production of natural asphalt; a half interest in American Gilsonite Co., and a minority interest in a company with Standard Oil Co. of California which manages refining and marine-terminal facilities at Perth Amboy, N. J.

Public Relations Groups Will Meet in February

NEW YORK.—All district organizing committees for the petroleum industry's public-relations program will hold meetings before February 15, Franklyn Waltman, acting chairman, of the public-relations operating committee told committee members last week at a meeting here.

The committee unanimously approved a statement of "objectives and principles of operation," which called for furtherance of understanding of the industry, maintenance of a free, competitive industry to serve the public, and to make more friends for the industry.

The committee approved a procedure for auditing the program's expenses and appointed W. V. Carver, Socony-Vacuum Oil Co., Inc.; Allen Howard, Shell Oil Co., Inc.; and R. G. Rankin, The Texas Co., as members of an auditing subcommittee.

Douglas Campbell, Pure Oil Co., was named chairman of a subcommittee to develop special events for the American Petroleum Institute annual meeting in November. In other moves, John S. Cooke, of the A.P.I., was elected secretary of the operating committee, and John Wieland, Standard Oil Co. (Ohio), and W. R. Huber, Gulf Oil Corp., were appointed to the advertising subcommittee.

February Crude Demand Set at 4,640,000 Bbl.

WASHINGTON.—A daily production of 4,640,000 bbl. of domestic crude will be needed in February to meet demand, according to the monthly estimate by the Bureau of Mines. The figure is the same as that for January and 140,000 bbl. below the estimate of 4,780,000 bbl. for December.

The bureau forecast a first-quarter demand for motor fuel of 177,000,000 bbl., an increase from its earlier forecast of 175,000,000 bbl. The crude-oil demand estimates for January and February were lowered to provide for a large seasonal reduction in distillate fuel-oil and kerosene stocks. February crude-demand forecasts in barrels daily included: Texas 2,030,000, California 838,000, Louisiana 387,000, and Oklahoma 370,000.

Murray Sworn In As Commission Member

AUSTIN.—William J. Murray, Jr., Houston, was sworn in last week as a member of the Texas Railroad Commission to succeed Beauford H. Jester, who appointed Murray as his successor.

W. J. MURRAY, JR.

Murray's appointment will carry him in office until January 1, 1949. To finish Jester's term on the commission, which expires January 1, 1951, Murray will have to be elected commissioner in 1948. Murray's appointment was announced early in December. (The Oil and Gas Journal, December 14, page 60.)

WASHINGTON WATCHING

BY HENRY D. RALPH

A Thorough Report

WASHINGTON. — The O'Mahoney report is an important document in the relationships between the federal Government and the petroleum industry. It is intended to be the basis of our national oil policy, and it should be accepted as such since it was drafted by a special Senate committee, created for the purpose, with membership drawn from all standing committees which regularly handle oil legislation.

It remains to be seen how much weight the recommendations will be given by Congress and the executive departments. But the industry can be counted on to keep the report in the public eye whenever policy questions are under consideration.

The document is more important than the reports of most congressional investigating committees because of the thoroughness with which it was prepared. It rests on nearly 3 years of careful study in which the hearings were notable for light rather than heat. Chairman O'Mahoney took great pains to be impartial and to get all facts and opinions into the record free from punitive or crusading spirit.

The oil industry itself is largely responsible for the thoroughness of this investigation. To each of the series of hearings it sent its most qualified experts to present data carefully worked out in advance by representative committees. As a result, the eight printed volumes of testimony constitute a valuable reference library on the oil industry in the United States and the world.

The Broad View

SOME criticism has already been heard that the O'Mahoney report is "weazel worded" in such generalized and guarded language that it can be used to prove most anything.

Such criticism is rather unfair. Not being a legislative committee, the group was not permitted to draft or endorse specific legislation. With a wide range of subjects to cover, and with many conflicting viewpoints to consider, the report had to be in general terms to keep within reasonable length. Moreover, the language had to satisfy a group of senators with differing political and economic philosophies. Finally, the document is designed as the outline of a long-range, comprehensive national policy which, it is hoped, will receive almost universal support; therefore it was wise to avoid being too specific and detailed on any particular point.

There is nothing in the report to which the oil industry as a whole should take exception. Certain groups may be disappointed at ommissions or failure to take a more unequivocal stand on some issue, while others can find loopholes through which they fear the ostensible policy may be evaded. But viewed in a constructive light the recommendations are basically sound, even though details of their application may bring controversy.

It should not be forgotten that the report is important because of what it might have said but didn't. It incorporates no brain-trust theories, no crack-pot schemes. It strongly supports a vigorous, competitive American petroleum industry doing business in pretty much the traditional way. Compared with most Senate investigations, the report is remarkably free from criticism, startling charges, and demands for reform.

Politics vs. Conviction

CONTINUATION of the Senate's special petroleum committee is a controversial question, involved in party politics.

Senator Moore of Oklahoma, who would be chairman if the committee is continued, has sponsored a resolution to that end but is not inclined to press for action immediately, being content to let the regular committees to which it has been referred express their views when they get around to it. The proposal is to draw members from standing committees dealing with oil legislation, such as foreign relations, public lands, and interstate commerce.

In prior years there would have been little opposition to continuance of a group like the special petroleum committee, but the new congressional reorganization act is supposed to have outlawed all special committees by strengthening the jurisdiction and staffs of the standing committees. At least that is how the Democratic minority interprets the law. But the Republicans managed to get through resolutions continuing the special war-investigating and small-business committees. It became a party issue when the Democrats decided to fight all special committees, charging that their only excuse is to create more committee chairmanships for Republicans.

This puts Senator O'Mahoney on the spot. As outgoing chairman of the old petroleum committee, and the senator who has taken the most active interest in all oil legislation, he personally favors continuation and normally would be expected to give strong support to the Moore resolution. But as a regular Democrat he hesitates to split off from his colleagues on a matter which has developed into a prime partisan issue.

One argument in favor of the petroleum committee is that it spent much less money than most Senate investigations. It had only two employes, a clerk and a part-time counsel, and in the slightly less than 3 years of its existence it spent $29,000, mostly for stenographic transcript and printing its hearings. Substantially the same amount probably would have been spent had the investigation been conducted by one of the regular Senate committees, as the Democrats say should be the procedure from now on.

Treaty Hearings

HEARINGS on the Anglo-American petroleum treaty may begin within a month if the Senate committee on foreign relations follows a suggested agenda submitted by the State Department.

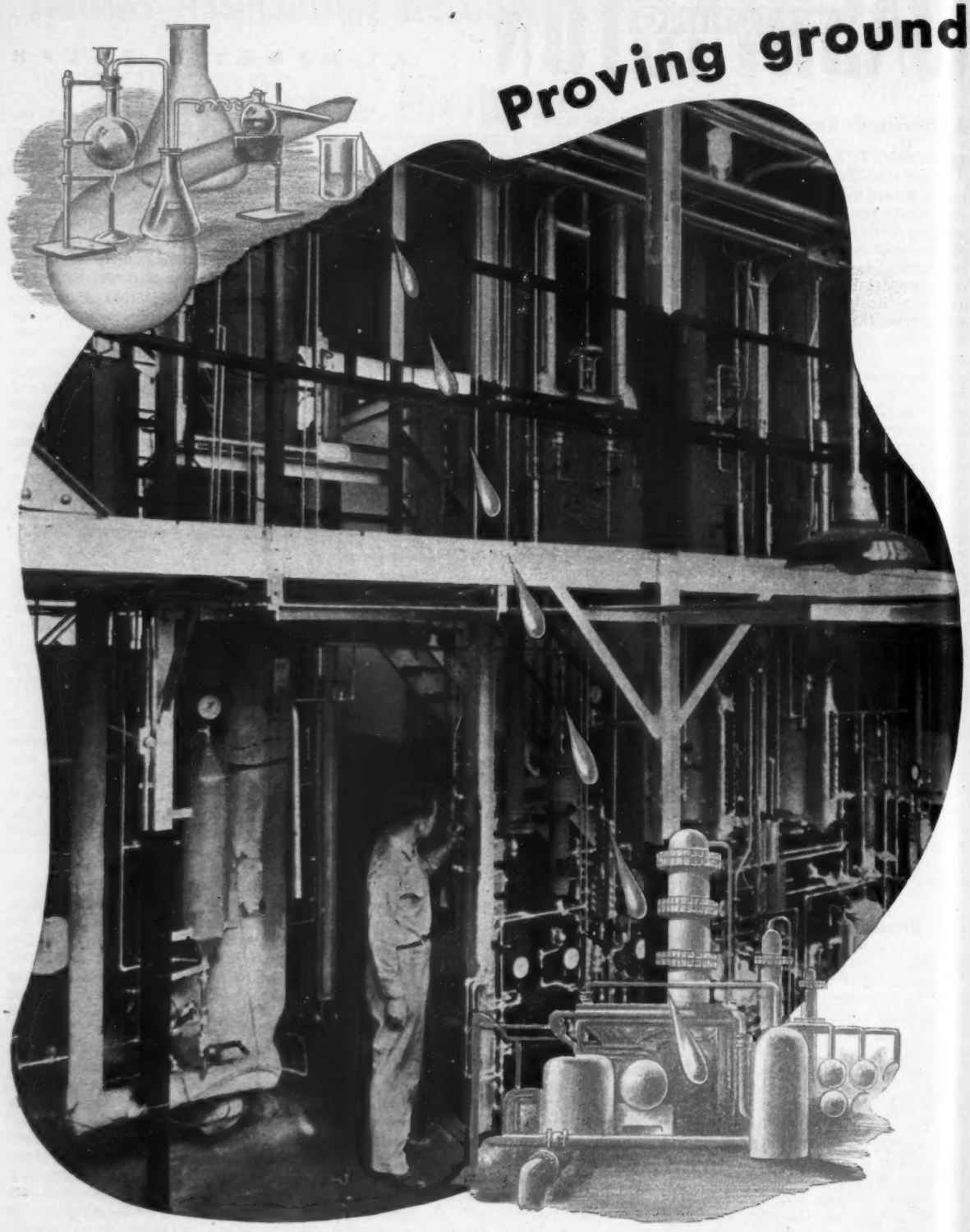
The department has drawn up a list of subjects on which committee action is desired at this session, and has indicated its preferences for order of action. First on the schedule is ratification of peace treaties with German satellite nations, and second is provision for foreign-relief needs. Number three is the oil treaty.

Assuming that the committee adopts this schedule and gets right to work, it is estimated that hearings on the first two subjects would take a couple of weeks each, so that consideration of the oil treaty could start early in March. The committee itself has not yet adopted a schedule, though it should do so soon.

Meanwhile the State Department is preparing material to present to the committee in support of the oil treaty. A number of oil men who assisted in its drafting probably will be asked to testify. Department officials are quite confident of ratification, feeling that the bulk of the opposition was swept away by the recent letter of Undersecretary Clayton to the A.P.I. board of directors. However, the Independent Petroleum Association of America is still on record as flatly opposing ratification, and many individual oil producers are expected to testify against the treaty.

(Continued on page 55)

Proving ground



One possible complication to early hearings is the fact that Secretary of State Marshall has asked Chairman Vandenberg and former Chairman Connally to accompany him to Moscow for the German peace-treaty negotiations. This conference does not open until March 10, so it would be possible to squeeze in the oil-treaty hearings in case these senators decide to make the Moscow trip.

Re Synthetic Fuels

TWO of Senator O'Mahoney's pet projects are given special emphasis in the petroleum-committee report, some may say undue emphasis. These are synthetic fuels and registration of corporations doing business abroad.

O'Mahoney authored the legislation under which the Bureau of Mines is conducting research into methods of making liquid fuels from coal, shale, and lignite, and he is now seeking to have the program doubled in size. At first glance this might seem to be government competition with the oil industry, or an attempt to undermine it. But OMahoney has always insisted that the Government confine itself to research and that private industry take over commercial production when the time comes. And the oil industry has never opposed this program, being confident that if a synthetic-fuels industry does develop it will be in the hands of oil companies.

One possible weakness of the OMahoney report is that it is silent on bridging the gap between synthetic-fuels research and commercial operations. It flirts with the idea of a tariff or other government means to raise crude prices to the point where synthesis will be economically feasible, but doesn't come right out with such a recommendation. It expresses the vague belief that continued cost reduction through research, plus rising crude prices due to increasing world-wide demand will make possible a gradual and painless transition to synthetic fuels.

Closer government supervision over corporations doing business abroad is an idea which O'Mahoney has incorporated in several bills he has introduced in recent years, based chiefly on his outspoken opposition to foreign cartels. This idea gets prominent, though not labored, discussion in the petroleum committee's report.

The reasoning is not to punish American oil companies for past transgressions, as there is no reference to any such in the entire report. It is simply that American oil companies in their foreign operations take on so many attributes of government, and depend so much on diplomatic support of our State Department, that our Government should always be fully informed about their plans, activities, and obligations. As Senator Moore pointed out in his concurring report, there should be no objection to this so long as the idea is not carried to extreme, such as disclosure of trade secrets or government dictation of foreign activities.

These two subjects are examples of how a broad policy statement must be couched in terms of generalized objectives on which there can be nearly universal agreement, leaving details and mechanism to be worked out elsewhere.

Significant Silence

ON two burning current petroleum questions the O'Mahoney report is significantly silent.

One of these is the Anglo-American treaty, now awaiting ratification. The ommission can be explained on jurisdictional grounds, since another committee of the Senate has the treaty before it, as well as by a desire to avoid controversial issues. However, the report is not the least antagonistic to the treaty, since it looks toward international order in the world's oil affairs and a favorable climate for the growth of foreign operations.

The other is the matter of imports of foreign petroleum. A number of passages could be used as arguments for higher tariffs barriers, and the reader gets the impression that the report's authors do not favor large imports.

Lease-Law Administration

A NUMBER of amendments and interpretations to the new oil and gas leasing regulations have been promised by the Bureau of Land Management as a result of a conference last week. F. H. Gower of the Rocky Mountain Oil and Gas Association presented reports on the regulations prepared by his group, the Mid-Continent Oil and Gas Association, and the federal-leasing committee of the National Petroleum Council.

The three reports cover substantially the same points, complaining of ambiguities in some sections of the regulations and taking direct exception to others. The chief complaints are that the regulations do not make a sufficient liberal interpretation of the intent of Congress in revising the Leasing Act, particularly on rentals, minimum royalties, acreage restrictions, and option privileges.

BLM officials explained that the regulations were promulgated quickly following the hearings in Denver last fall in order to put them into effect at once without waiting for further consultations with the industry. They promised to give careful consideration to all of the industry's complaints and suggestions, and to confer with the Oil and Gas Division and the Geological Survey.

Corrosion Committee Report Progress

MEMBERS of the Natural Gasoline Association of America's corrosion committee and the National Association of Corrosion Engineers, meeting jointly in Houston recently, discussed progress in corrosion studies during the past quarter. The 3-day session began with the N.A.C.E. meeting Wednesday, when work on high-pressure gas-condensate corrosion was considered. In cooperation with the N.G.A.A. group, the association is planning to conduct field tests on 32 different alloys to determine their relative resistance to corrosion. Coupons of these alloys will be subjected to long-term exposure tests in corrosive wells.

The N.G.A.A. committee Thursday and Friday heard progress reports on alloys and inhibitors under consideration for the same type of corrosion prevention. The Bureau of Mines, which is working in conjunction with the two other research groups, reported on laboratory tests made on 70 alloys. The results indicate that no low-cost alloys have been found which show any particular promise of economical use in corrosive wells and surface connections. The relative high cost of finished alloys as compared to the cost of ingredients which go into their manufacture was brought to the attention of the group, the possibility of price reduction for large-tonnage shipments is being investigated. Present findings indicate that this will be necessary before alloys can find widespread use in corrosive fields.

In the field of inhibitors, Kontol 115, first reported on at the quarterly joint meeting last fall, has proved effective in all wells of West Tuleta field, Bee County, South Texas. It is now being used successfully in other corrosive fields but generally with less efficiency than that shown at West Tuleta. Further employment of the new inhibitor will continue in additional gas-condensate fields. The Bureau of Mines reported that technique in injecting sodium chromate at Cotton Valley had been improved to the extent that it no longer restricts flow of wells. Alkali inhibitors continue to give satisfaction in fields where connate water exists in small quantities, but plugging still prevents their effective use in fields producing larger amounts of connate water.

"Ring worm" corrosion was described in a report on laboratory tests conducted by Phillips Petroleum Co. The great importance of proper heat treating to provide corrosion resistance was demonstrated from results of the laboratory study conducted on sucker-rod samples.

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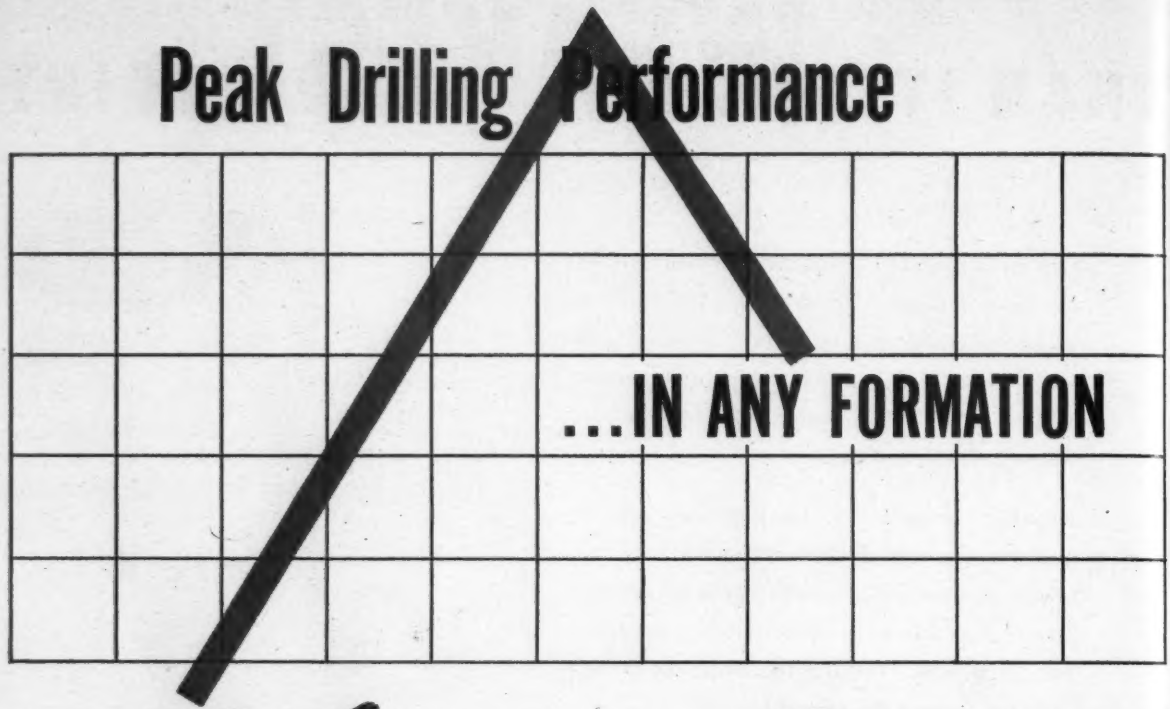

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Markets Steady Except for Drop in East Coast Burning-Oil Price

HOME heating-oil prices on the East Coast have fallen again under the impact of continued slack demand caused by generally unseasonably warm weather through much of the area.

Socony-Vacuum Oil Co., Inc., January 31 announced a third reduction of both wholesale and retail prices of No. 2 fuel oil within a month in New York harbor and the greater New York area. New postings were 6.2 to 6.1 cents tank car and 6.1 to 6 cents barge.

Light heating oils have shown marked weakness in the East most of the winter. Suppliers stocked heavily in anticipation of demand paralleling that last winter, but the weather has checked usual cold-weather movement. Kerosene also was reported slack. Though some large suppliers in New York said residual fuel oil was extremely tight, other reports were that some offers were made shading the posted price of 5.46 cents to 5.27 cents and below. Gasoline demand was steady in the New York area.

The marketing picture was generally bright elsewhere in the country. Movement of all products was heavy. Winter motor-fuel demand was so strong many suppliers feared lack of current stock accumulation will make it difficult to meet peak summer requirements.

On the Gulf Coast and in the Mid-Continent, brisk movement of kerosene was reported in the Mid-Continent, major companies were said to be buying motor fuel heavily, and pipe-line gasoline in the midwestern marketing territory was reported bringing over-market prices.

In Texas, a ½ cent advance was posted in the tank-wagon price for gasoline, attributed to generally increased costs and to the recent freight rate increase. In Dallas, the tank wagon for regular was 15½ cents. The advance was the first generally for Texas since the 25-cent crude increase last year.

A fact already recognized by oil marketing officials—that postwar motorists are using more gasoline in fewer vehicles—was brought out statistically by a report of the American Road Builders Association. The data explained the apparent contradiction of a decline in total vehicle registrations and a greatly increased gasoline consumption. It also gave an indication of the still heavier demand to come with full automobile production.

The association report said the average passenger car used 651 gal. of gasoline and drove some 9,765 miles in 1946. The 1,359,244 fewer cars and trucks registered in 1946 than in 1941, used a billion gallons more gasoline. In 1946, highway gasoline consumption rose to 25,200,000,000 gal. Recent surveys indicate, the report noted, that 30.6 per cent of the nation's families are waiting to buy new cars.

Another report issued by the Public Roads Administration, said travel on rural roads during 1946 broke all records, rising to an all-time high of 170 billion vehicle-miles from a wartime low of 101 billion miles and exceeding the volume of travel in the prewar peak year, 1941, by approximately 200 million miles. The increase was largely due to considerable gains in the western states, it added.

Oklahoma, Louisiana Allowables Boosted

OKLAHOMA and Louisiana regulatory bodies have raised oil allowables for February, scheduling for Oklahoma a 9,300-bbl. increase with an allowable of 371,000 bbl. and setting for Louisiana a 483-bbl. boost with an allowable of 446,909 bbl. daily.

The Arkansas Oil and Gas Commission set production for February, March, and April at 85,210 bbl., and in Kansas, the Corporation Commission accepted the recommendation of T. A. Morgan, director of the conservation division, to keep the February allowable at 270,000 bbl. daily.

Louisiana's increase was the smallest shown in recent months. The January allowable of 446,426 bbl. daily was 5,015 bbl. above the December allowable and 6,426 bbl. above the November figure.

Arkansas' allowable of 85,210 bbl. includes 63,830 bbl. daily from controlled oil pools, 3,280 bbl. from controlled gas pools, 2,350 from two pools with allowables based on the demand for gas produced and utilized in accordance with the Act of 1939, and 16,750 bbl. from unprorated pools. Gas production from controlled gas pools was set at 47,800,000 cu. ft. daily.

Index Now Ready

The complete editorial index of The Oil and Gas Journal for 1946 is now ready and will be sent without charge to all subscribers requesting a copy. This 48-page index is bound separately, and is more completely cross-indexed than ever before. Address requests to Circulation Department, P. O. Box 1260, Tulsa.

DEATHS

Paul H. Boots, assistant manager of Colombian Gulf Oil Co., and three other Colombian Gulf employes, were killed January 22 when an Avianca airliner exploded in the air 40 miles southeast of Barranca Bermeja, Colombia. The others who were killed were: **Arthur K. Dacy,** recently employed by Gulf as industrial-relations representative; **Dr. Rafael Navia,** a Colombian and company attorney in Bogota; and **Jorge Cortazar,** personnel clerk in the Bogota office. Boots, a geophysicist, had been with Gulf since 1932, and spent the first 12 years in Gulf Research and Development Co. He became assistant manager of Colombian Gulf May 1, 1944. Nine other passengers and four crew members were casualties in the accident.

Jacob A. Grubb, Wichita, manager of Black, Sivalls & Bryson Tank Co., was killed January 29 in an automobile accident near Cleveland, Kans.

Frank W. Perry, retired oil broker, died January 31 at his home in Tulsa.

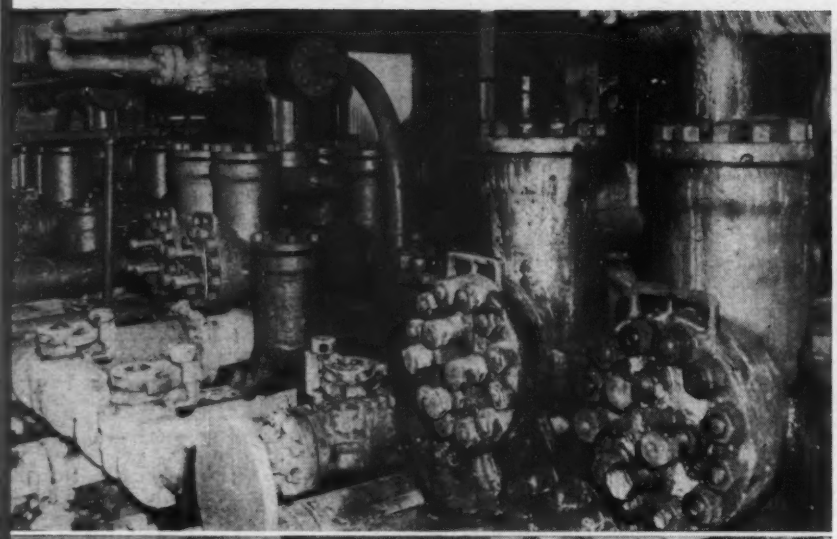
James Melvin Sloan, 75, Parker, N. Y., retired official of Northern Pipe Line Co., died January 25 while visiting in El Dorado, Ark.

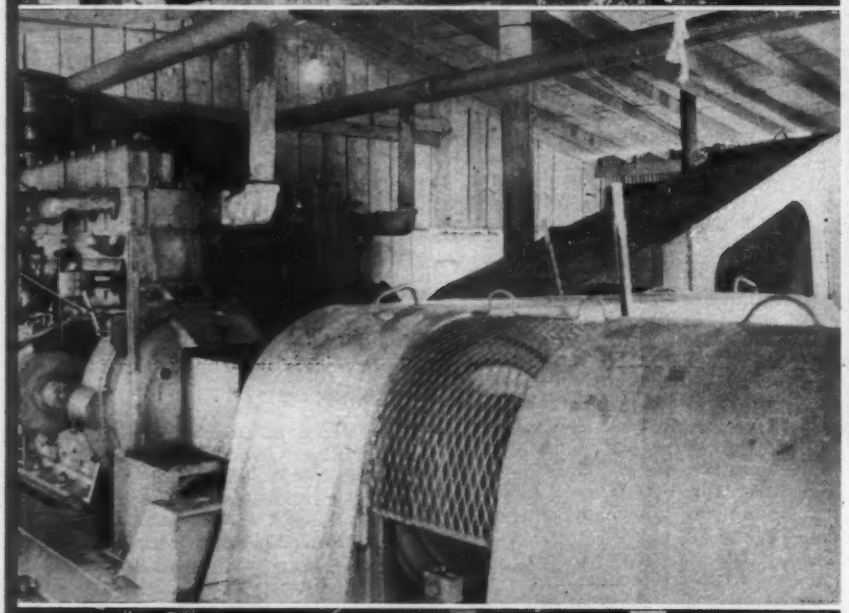
Howard Kenton Kietterich, 71, general superintendent of gas purchasing for North Penn Gas Co., died January 24 in an Oil City, Pa., hospital.

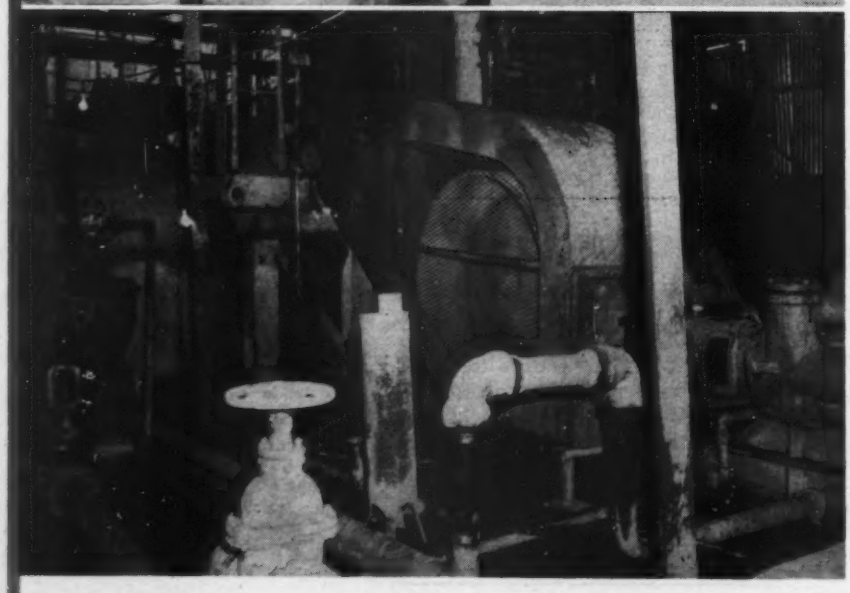
James P. Andrews, 85, foreman of stills in the Eclipse Oil Works of Atlantic Refining Co. until his retirement 17 years ago, died January 25 at his home in Franklin, Pa.

M. S. Jordan, 42, production superintendent for Sun Oil Co., in the Premont, Tex., district since 1929, was killed January 28 in an oil-field accident.

Verner D. Tilden, 70, once a partner in the Halden Oil Co., Tulsa, and later associated with several oil-field supply firms, died February 3 in Okmulgee, Okla.



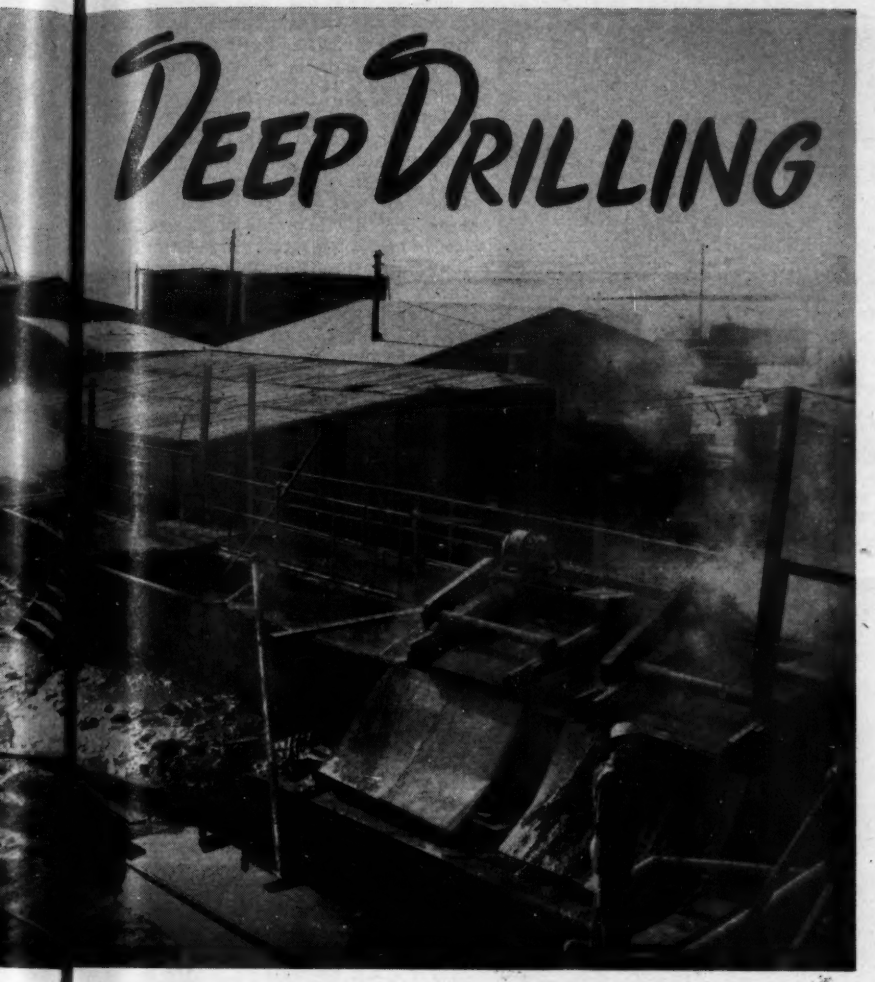




Left, top: Steam mud-pump installation including one 19 by 9¼ by 22-in. pump (right), largest pump made, and two 15½ by 8½ by 20-in. pumps. Additional 7¾ by 18-in. pump, powered by two 410-hp. gas engines, also is provided and now used for normal mud circulation requirements to conserve on steam use

Left, center: Large power pump installation showing compound drive from two 410-hp. gas engines. This pump currently being used on steam rig to relieve steam pumps and conserve on steam use

Left, bottom: Mud pump floor on large power-rig assembly at Church Buttes. Both pumps are V-belt driven from compound of four 410-hp. gas engines. Pump at left serves as standby and for mixing. Main pump at right is 7¾ by 18-in. unit. Additional pump of latter size and separately powered by two 410-hp. gas engines belongs with rig



Mud-circulatory system and power-plant layout on steam rig operation in Church Buttes field, Wyoming, as viewed from derrick floor. Buildings in center back of steel mud tanks house mud pumps, including one 22-in. and two 20-in. steam pumps and one 18-in. power pump with two 410-hp. gas engines

in the Rocky Mountain Region

by Neil Williams

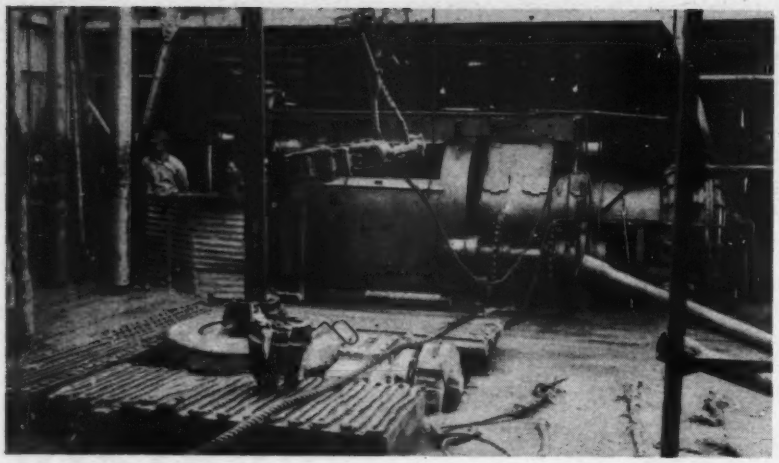
DEEPEST development currently under way in the Rocky Mountain region is on the Church Buttes structure in the Green River basin, southwestern Wyoming, where Mountain Fuel Supply Co. is drilling two tests to depth objectives of 13,000 ft. Drilling of these tests follows the completion last April of a well in which high-pressure gas-distillate production was found in Dakota sands at a total depth of 12,894 ft. The present program calls for two additional tests, locations for which will be dependent upon results of the two wells now drilling. Drilling is being done by Rocky Mountain Drilling Co., utilizing two of the largest rigs ever assembled in the Rocky Mountain region.

The Church Buttes structure underlies a unitized lease block totaling approximately 50,000 acres, embracing parts of Townships 15, 16, and 17 north, Ranges 112 and 113 west, and 18 north, Range 112 west, and lying partly in Uinta and partly in Sweetwater counties. The land, consisting of winter range, is owned largely by the federal Government and Union Pacific Railroad with some interspersed sections owned by the state. Mineral rights are held in alternate sections by Mountain Fuel through its leases and Union Pacific, through its ownership of mineral rights. These were unitized in 1942 with the former company designated as the operator. Existence of the structure was indicated by geophysical work in 1938 and 1939 and by reflection shooting conducted in the Green River basin during 1940 and 1941. General Geophysical Co., Houston, did the seismograph work for Mountain Fuel.

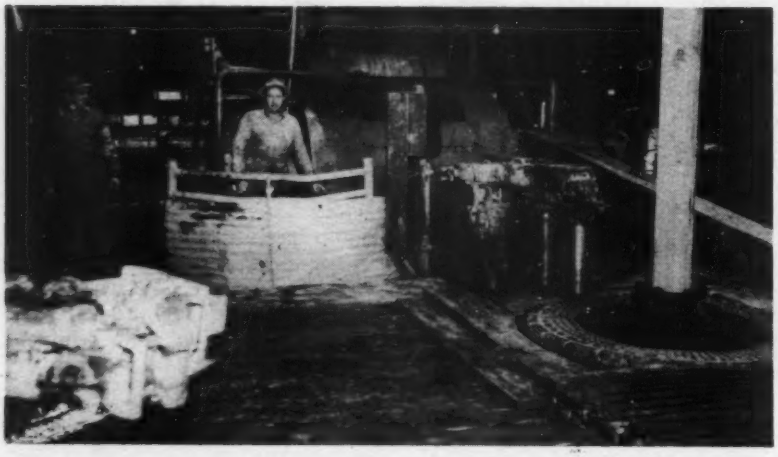
Unusually difficult development conditions, occasioned by both the hard formations and great depths and by comparative isolation and inaccessibility of operations during bad-weather periods, have been encountered. Hard formations have made drilling progress slow and tedious, required an excessive number of bits, and contributed substantially to the high costs involved. Twistoffs have been exceptionally frequent. These have occurred mainly in the drill-collar assemblies and have been attributed to excessive vibration resulting from rotation on the hard formations. Although fishing jobs so far have not been serious in themselves, their number has created a nuisance and increased over-all drilling time.

At the start of development there were no roads into the well locations, a distance of approximately 10 miles from the nearest highway. Although since then a roadway has been constructed by the operator, work of improving and topping it has been delayed by difficulties of obtaining materials and equipment, and during bad-weather periods it is all but impassable. This has imposed problems in transportation of needed equipment and supplies, and necessitated anticipation of possible requirements and keeping extra equipment and tools and stocks of supplies on hand to prevent undue shutdowns and delays in drilling. With an elevation of more than 7,000 ft. above sea level, the area is subject to extremely cold weather during the winter months which adds to drilling problems and incurs hardships upon personnel.

Drilling of the first well (Unit No. 1), located in Section 8-16n-112w near the center of the block and at the indicated highest part of the structure, was started February 11, 1945.



Derrick floor on steam rig showing main draw works. Assembly has auxiliary and standby draw works (not visible) located on front side. Man at left is Wayne Ewing, toolpusher for Rocky Mountain Drilling Co.



Derrick floor of power rig showing new National 125 draw-works assembly. Power-slips installation is shown in front of draw works. At brake is Pete Hall, day driller. M. L. Swanson, roughneck, looks on

Original contract was to Manning & Martin, which contractors, using a medium-heavy power rig, carried the hole to a depth of 11,142 ft., reached October 15, the same year. At that depth, because the equipment was considered too light for deeper drilling, this rig was moved off and replaced with a large steam rig by the present contractors. The latter rig was started up December 24 and completed the hole to its total depth of 12,894 ft. the latter part of March 1946. Including the time for changing rigs and for completion tests, a total of 14½ months (approximately 441 days) was spent on the well.

The drilling program for this well called for 16-in. o.d., 70-lb. surface casing, set and cemented at 288 ft.; a 9⅝-in. intermediate string, made up of 40-lb. J-55 and 43.5 N-80 pipe, set and cemented at 6,939.8 ft., and the 6⅝-in. production string, consisting of 28 and 32-lb. N-80 extreme line pipe, cemented at 12,879 ft. with 1,200 sacks of cement. Surface hole was drilled with 12¼-in. bit and reamed to 17½-in. The intermediate casing string hole was alternately ratholed with 9⅞, 9⅝, and 9-in. bits and reamed to 12¼ in. Below this string, 8⅝-in. hole was carried to bottom. Including coreheads, 231 bits were used. Prior to running casing, both Schlumberger and radioactive and velocity surveys were made in the hole. Fifteen neutron log bullets were placed for markers, of which nine were located.

A series of hook-wall packer production tests were made at various levels, the lowest being through perforations at 12,774 ft. Preliminary tests were made through perforations at 12,640-66 ft., 12,572-606 ft., and 12,550-64 ft. On one incomplete 3½-hour test, the well flowed at the rate of 28,633,000 cu. ft. of gas and about 150 bbl. of 50.5° gravity distillate daily through a ⅞-in. choke. At the start of the test pressures built up to 5,300 psi. on the tubing and 5,375 psi. on the casing. Bottom-hole pressure was calculated at more than 7,100 psi.

During the tests it was indicated there might be a leak in the casing, and because of the high pressures and danger of charging upper sands the well was killed by filling the hole with 12-lb. mud. Since then the well has been standing closed in. Although the flow from the lower sands has been killed, as indicated by the absence of any pressure on the 6⅝-in. casing, and the hole stands full of mud, pressure continues to show behind this pipe. The latter is taken as an indication gas may be coming in from upper sands through possible casing leaks or below the 9⅝-in. casing. This pressure, however, has been declining steadily and now is approximately 1,100 psi. as compared with about 5,000 psi. at first. Repair operations are now under way and the well should be ready for final testing shortly.

Now drilling are Unit No. 2, located approximately 5 miles northeast of the discovery well in the northeast corner (330 ft. from the north and east lines) of Section 22-17n-112w, Sweetwater County, and Unit No. 3, located about a mile to the west of the discovery well in Section 12-16n-113w (1,650 ft. out of the northeast corner), Uinta County. The former, using the large steam rig moved from the discovery well, was started June 23, 1946. Although the steam rig had nearly 1½ months' head start, both wells are drilling, as this is written, at approximately the same depths, slightly below 8,900 ft. The faster time by the power rig has been due largely to certain innovations in drilling procedure that eliminated much reaming.

The steam rig assembly includes a double draw-works installation, consisting of the main and larger draw works driven by a 14 by 14-in. twin-cylinder engine, and an auxiliary unit on the opposite side of floor

(Continued on page 88)

On-the-spot data for this article, as well as others to follow and some already published, were gathered by the author during an extended tour of drilling and producing operations throughout the Rocky Mountain area. Recent articles on the area have been published in last week's issue, "Mobile Rotary Drilling Unit," and in the issue of January 4, "Diamond Bit Coring in the Rangely Field." Williams is associate editor of the Journal, and one of its veteran engineering writers.

Nature of multipay zones in Fullerton field necessitates care in selection of Completion Methods

by George Weber

IN the Fullerton field of Andrews County, West Texas, completion practices have been subject to considerable study by petroleum engineers. The problems involved are representative of those encountered in many other Permian basin fields. Fullerton pay occurs in several dolomite zones which vary in porosity, permeability and acidizing breakdown pressures. Careful attention to these individual zones is necessary in selecting completion methods which will prevent damage to the formation at well bores, and result in maximum productivity indices.

A major reserve, Fullerton currently produces from four horizons of Permian, Devonian, and Ordovician age. The shallow San Andres pay at 4,550 ft. has but one well completed to date, producing on artificial lift. Deeper in the Permian, the Lower Clear Fork formation, principal pay of the field, produces from four saturated zones, each comprising a series of porous dolomite and calcareous dolomite streaks. A total of 410 Clear Fork wells have been completed and the formation is almost completely drilled over the anticlinal structure.

The first zone of the Lower Clear Fork is encountered at from 6,700 ft. at the crest of the structure, to 7,050 ft. on the flanks. Total thickness of the section including all four zones averages 450 ft. Both porosity and permeability of the pay streaks are fairly uniform, although they vary from extremes of 4 to 32 per cent porosity and 0.1 to 2,115 md. permeability. Characteristics of the three principal zones are shown in the following table:

	1st zone	2nd zone	3rd zone
Average porosity, %	9.7	12.5	12.7
Average permeability, md.	12.6	8.5	6.7
Average thickness, ft.	75	210	165

A fieldwide average for neither the permeability nor thickness has been determined for the fourth zone. Its porosity averages 15.6 per cent and permeability in general exceeds 200 md. The impermeable, nonporous intervals between pay sections vary in thickness as much as 200 ft. over the structure.

Below the Permian, the 8,500-ft. dolomite of Devonian age is producing in 43 wells and three 9,700-9,900-ft. producers have been completed in the Ellenburger (Ordovician) currently undergoing initial development.

Casing and Acidizing Practices

Casing programs in Fullerton and Clear Fork wells are fairly uniform, calling for 13⅜-in. surface strings and intermediate casing ranging from 7⅝ to 9⅝-in. set largely below the salt stringers at 4,000 ft., in later wells. Over 80 per cent of wells are completed with 5½-in. production strings, the remainder being 7-in. casing. All four zones produce oil in wells at the top of structure, and dip successively below separate oil-water contacts toward the field's flanks. Penetration below the top of the first zone exceeds 500 ft. on top of structure and averages 345 ft. for all Clear Fork wells in the field.

Acid was used in over 95 per cent of Clear Fork wells completed at Fullerton. Wells producing from all zones generally took about 20,000 gal. in from one to three or more stages and the average treatment for all wells was a little under 12,000 gal. Over 4,200,000 gal. have been used to date in Clear Fork wells.

Completion Methods Used

Completion and acidizing practices have followed four general methods; three with production casing set above the zones and the fourth with casing set through all zones and perforated. About 85 per cent of all wells produce from open hole below casing set at or near the top of the first porous zone. Several of the 23 operators in the field have set casing through the section and perforated in some of their wells and two companies have followed that practice consistently.

Completion through perforations, widely successful in multiple-zone fields in other areas, would be accepted practice at Fullerton were it not for two factors which limit its effectiveness. Although the three main porous zones appear to be separated in most wells by impermeable strata, it is not possible in all cases to prevent communication between pay

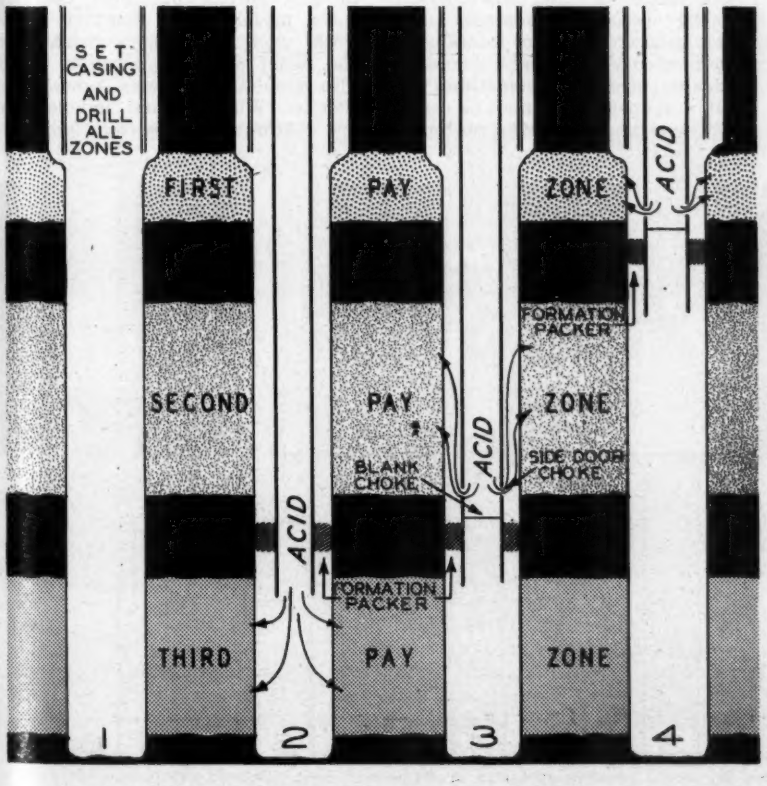


Fig. 1—Selectively acidizing three Clear Fork zones after drilling full section

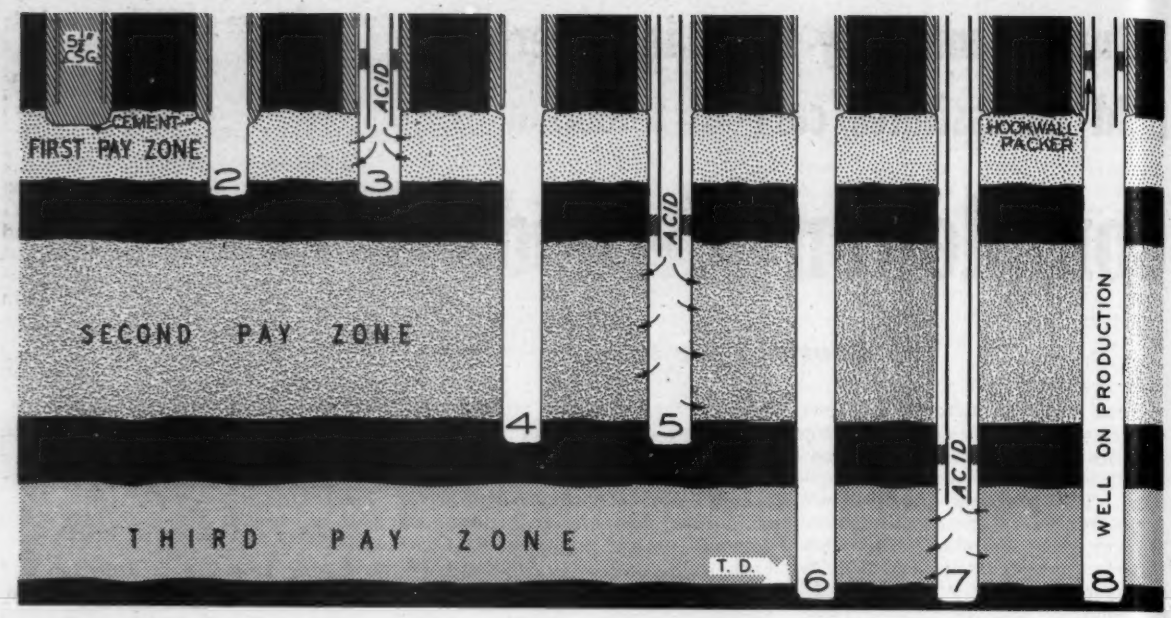


Fig. 2—Clear Fork completion method, drilling pay zones individually and acidizing selectively

zones immediately outside the casing. Channeling of cement, or its penetration by acid, or a combination of both situations have resulted in a number of cases where selective acidizing of individual zones was made impossible by movement of acid to a zone lower than the one under treatment. It was found in general that acid communication between perforated sections was fairly common outside blank casing sections up to 30 ft. in length, but that isolation of zones could be reliably expected if the blank section exceeded 60 ft.

In cases where channeling has resulted, corrective measures are difficult and uncertain, and future remedial work may be complicated by uncertainty of the source of intruding gas or water. But successful completions by this method are possible and some wells have been selectively acidized and completed for good producers through perforations. An additional factor is cited by engineers favoring open-hole completions. Determination of the exact location and extent of the permeable dolomite producing streaks is sometimes difficult, and operators cannot be certain in all cases that they have perforated opposite the most effective pay sections in each zone. The problem of selecting perforation points is further complicated by a lack of knowledge as to what constitutes the lower permeability limit of effective pay.

Open Hole Completions

Because of the risks encountered in gun perforation, most operators have preferred to complete Clear Fork wells with open holes. It is the belief of such operators that it also results in greater productivity indexes. While greater indexes may

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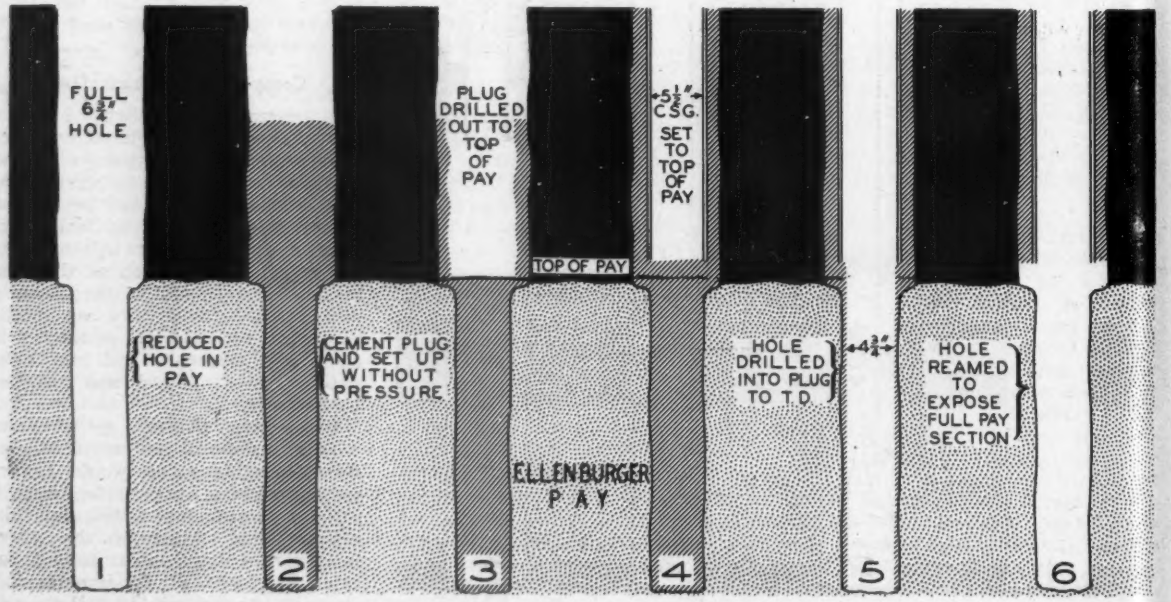

Fig. 3—Completion method used for Fullerton Ellenburger

MULTISTAGE Centrifugal Compressor APPLICATIONS

by T. R. Foster*

IN recent years there have been large-capacity increases in oil-industry and chemical-process-industry gas and air-compression requirements.

New processes have been introduced that likewise require larger-capacity compression equipment. Consideration of centrifugal compressors has followed as a natural outgrowth of this higher-capacity trend. Centrifugal compressors have their greatest economic significance on high-capacity applications.

In the past high-capacity centrifugals were synonymous with high volume as most centrifugal blower applications operated at discharge pressures below 50 lb.

*Clark Bros. Co. Abbreviated from a paper presented at a meeting of California Natural Gasoline Association, Los Angeles, December 5, 1946.

In the centrifugal compressor field, high capacity may imply higher weight flows due to high gravity or higher pressure with its attendant lower relative volume.

High-pressure centrifugal compressors will ofttimes be employed on smaller inlet volume applications than has heretofore been economically feasible in centrifugal blower practice as the shaft horsepower will be high enough for a commercial centrifugal application.

The term compressor, in this instance, is used to signify a machine of radial design incorporating two or more shrouded-type impellers in series discharging gas or air at pressures in the range of 50 to 500 psi.

Table 1 covers a so-called line of such compressors, covering a range of 2,000 to 60,000-cu.ft.-per-minute inlet volume and maximum discharge pressures from 110 to 300 psi. in semi-steel. An additional number 1½, 13½-in.-diameter impeller compressor permits us to accommodate lower volumes and higher discharge pressures. The smaller-size machines are available with steel cases which also permit somewhat higher discharge pressures.

Since these machines are not intended for duties of 200,000 to 300,000-cu.-ft.-per-minute inlet volume, that might be more economically served by an axial flow type blower, they may be said to have an economic upper limit of capacity of 120,000 cu. ft. per minute and 22,000 hp. Horsepowers of this magnitude are accommodated by utilizing the drive-through principle.

The lower limits of capacity will have to be resolved more often, and since the compression through the compressor results in a reduction in volume, the exit volume is the limiting factor.

Exit volume of 500 cu. ft. per minute and 500 hp. per case, or stage of compression, are round numbers that may be used as a yard stick in determining whether a nonrefrigerating duty warrants a centrifugal compression investigation. Minimum inlet volume of 1,500 cu. ft. per minute may be considered as a similar yard stick.

A few applications employing direct steam-turbine drives exhausting live steam to process may prove economically feasible down to 300 hp., but most commercial applications may be expected to fall in the 500-hp. and higher capacity range.

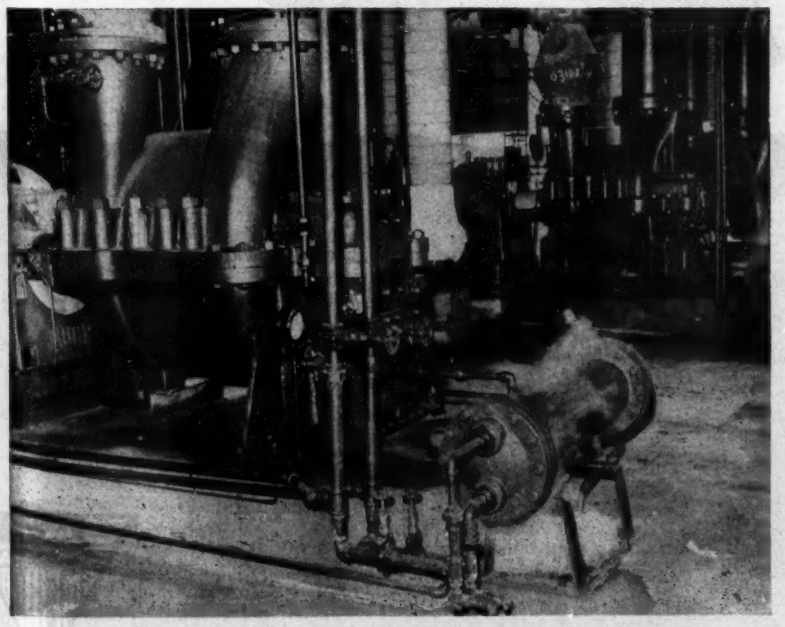

Fig. 1—This is believed to be the first United States mixed petroleum-hydrocarbon gas-compression installation operating from atmospheric to discharge pressure above 100 psi. The machines operate on 40-mol-weight gas in the Cities Service Refining Co. butadiene plant at Lake Charles, La.

Utility and Driver Costs

Utility and driver costs vary to the extent that it is an impossibility to make factual statements regarding gas or air-compression duties that might profitably be served by centrifugals.

In general large-capacity centrifugal air compressors find their greatest usage where fuel cost is low. This is true in the case of blast-furnace blowers and fluid cat-cracking units. On the other hand, many municipal and manufactured gas duties have been and are being accommodated by centrifugals.

Probably the first centrifugal refrigeration installation in the United States refining industry were two units employing 450 hp. electric motor drivers. These units have operated for the past 8 years on brine-cooling duty at the Standard Oil Co. of New Jersey refinery at Bayway. Operating experience shows these units have been highly satisfactory insofar as the centrifugal compressors are concerned. Periodic exchanger-tube failures have indicated the desirability of using standard oil-industry-type heat exchangers and cheaper petro-

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TABLE 1—MULTISTAGE CENTRIFUGAL COMPRESSORS—STANDARD SIZES

Model—	No. 2 Compressor				No. 3 Compressor			No. 4 Compressor			No. 5 Comp'r	
Stages—	3	4	5	6	3	4	5	3	4	5	3	4
Capacity—C.f.m.—Approx. max.	7,000	7,000	7,000	6,000	18,000	18,000	14,000	32,000	32,000	25,000	60,000	60,000
Capacity—C.f.m.—Approx. min.	2,000	2,000	2,000	1,700	6,000	6,000	4,500	12,000	12,000	9,500	24,000	24,000
Total weight—lb.	7,400	7,950	8,500	9,050	13,400	15,000	16,600	23,500	27,000	30,300	48,000	55,000
Normal speed—r.p.m.	9,800	9,800	9,800	8,300	7,350	7,350	5,700	5,500	5,500	4,300	4,150	4,150
Suction opening—dia. in.	.....	.....	12	.....	.....	20	.....	.....	30	.....	.....	36
Discharge opening—dia. in.	.....	.....	8	.....	.....	14	.....	.....	20	.....	.....	24
Impeller—dia. in.	.....	.....	18	.....	.....	24	.....	.....	32	.....	.....	42½
Intake press.—psig.	.....	.....	150	.....	.....	100	.....	.....	80	.....	.....	60
Discharge press.—psig.	.....	.....	300	.....	.....	200	.....	.....	150	.....	.....	110
Max. shaft hp.	.....	.....	7,000	.....	.....	10,000	.....	.....	15,000	.....	.....	22,000

leum-industry-type refrigerant as the exchanger maintenance and refrigerant replenishment has been excessive.

Fig. 1 is probably the first United States mixed petroleum-hydrocarbon gas-compression installation operating from atmospheric pressure to discharge pressure above 100 psi. The discharge pressure is 125 psig.; four compressors of approximately 1,300 hp. each direct connected to steam turbines exhausting to process are involved. The machines operate on 40-mol-weight gas in the Cities Service Refining Co. butadiene plant at Lake Charles, La.

Fig. 2 shows what are probably the first United States centrifugal refrigeration machines employing petroleum hydrocarbon as the refrigerant medium. They operate on lean-oil chilling at the La Gloria plant near Corpus Christi, Tex. The machines are direct driven by 375-hp. steam turbines, and are significant of the trend to petroleum hydrocarbon refrigerants in centrifugal compressors.

It is apparent that centrifugal compressors have gained a certain degree of acceptance in the petroleum industry, and petroleum engineers are hence becoming interested in the theory and machine characteristics.

The pertinent theory and operating characteristics are not similar to reciprocating compressor characteristics and attempts to evaluate the operating characteristics of either from the other viewpoint are confusing.

Fortunately, most petroleum engineers are familiar with centrifugal liquid pumps and approach from the liquid-pump viewpoint rather than the reciprocating gas-compressor viewpoint may help engineers to properly evaluate the machines.

Professor Church has published a text in which he combines centrifugal pumps and compressors and successfully covers both due to the similarity of the underlying theory.

While the liquid pump operates with equal pressure rise, constant volume, and approximately constant temperature through each impeller, the uncooled gas pump operates with variable pressure rise, volume, and temperature. The gas-pump impellers may be selected for equal diameter but the width of the impellers is decreased as we progress through the machine. The multistage liquid pump may employ identical impellers throughout.

Neglecting viscosity, both the centrifugal gas pump and liquid pump are independent of density as regards head. The centrifugal gas pump will develop the same head whether handling hydrogen or mercury vapor. The pressure ratios for a given head or number of impellers vary markedly however. It will be noted that a 5-impeller compressor will produce a pressure ratio of approximately 2 to 1 when compressing methane, while the same number of impellers (or head) will produce approximately 12 to 1 when compressing butane.

With equal pressure ratios the deviations from adiabatic for uncooled centrifugals are by no means constant. We have a 5 per cent variation with air, a 4 per cent variation with sulfur dioxide, and a 2.1 per cent variation with propane. The gravity of the gas does not explain this variation as sulfur dioxide with the higher gravity has a greater variation than propane. The ratio of specific heats seems to have the most marked effect.

It would appear that the great variety of gases, with varying specific heat ratios and compressibility characteristics, that could conceivably be compressed centrifugally will require some special consideration if inaccuracies in horsepower and speed calculations are to be avoided.

It is recognized that the use of an adiabatic base and of Mollier diagrams permits rapid calculations of compression horsepower requirements, and is favored by engineers in the industry. With reciprocating compressors the variation between the pseudo-adiabatic base and the actual is small with water-jacketed cylinders, and adiabatic therefore provides the required accuracy. Uncooled centrifugals cannot be selected with accuracy on an adiabatic basis if gases of widely divergent specific heat ratios are to be accommodated from the same rating data. Practically all the losses in a centrifugal tend to heat the gas and accentuate the variations. Mechanical losses are the only external losses and seldom exceed 1 per cent.

Personal experience with the use of the actual polytropic concept and hydraulic efficiency as used by hydraulic turbine and pump designers does not render us unmindful of the point that an adiabatic air or equivalent base could be used and corrective

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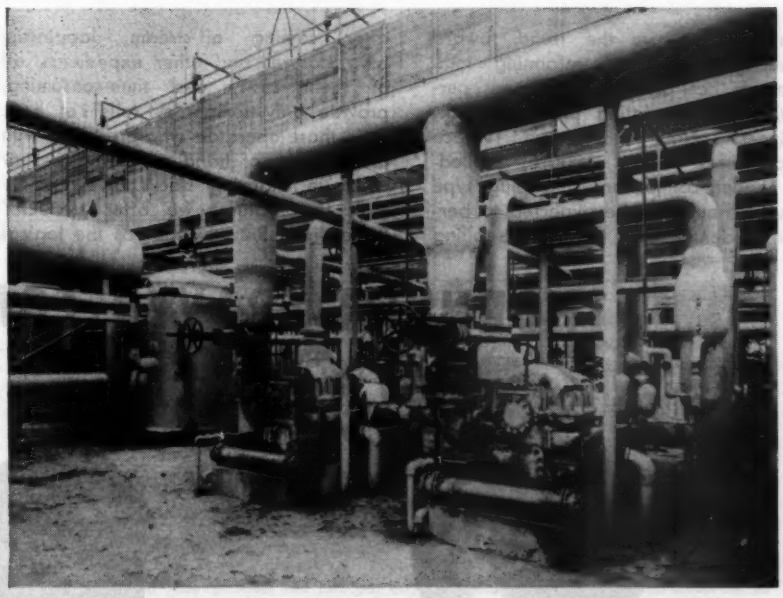
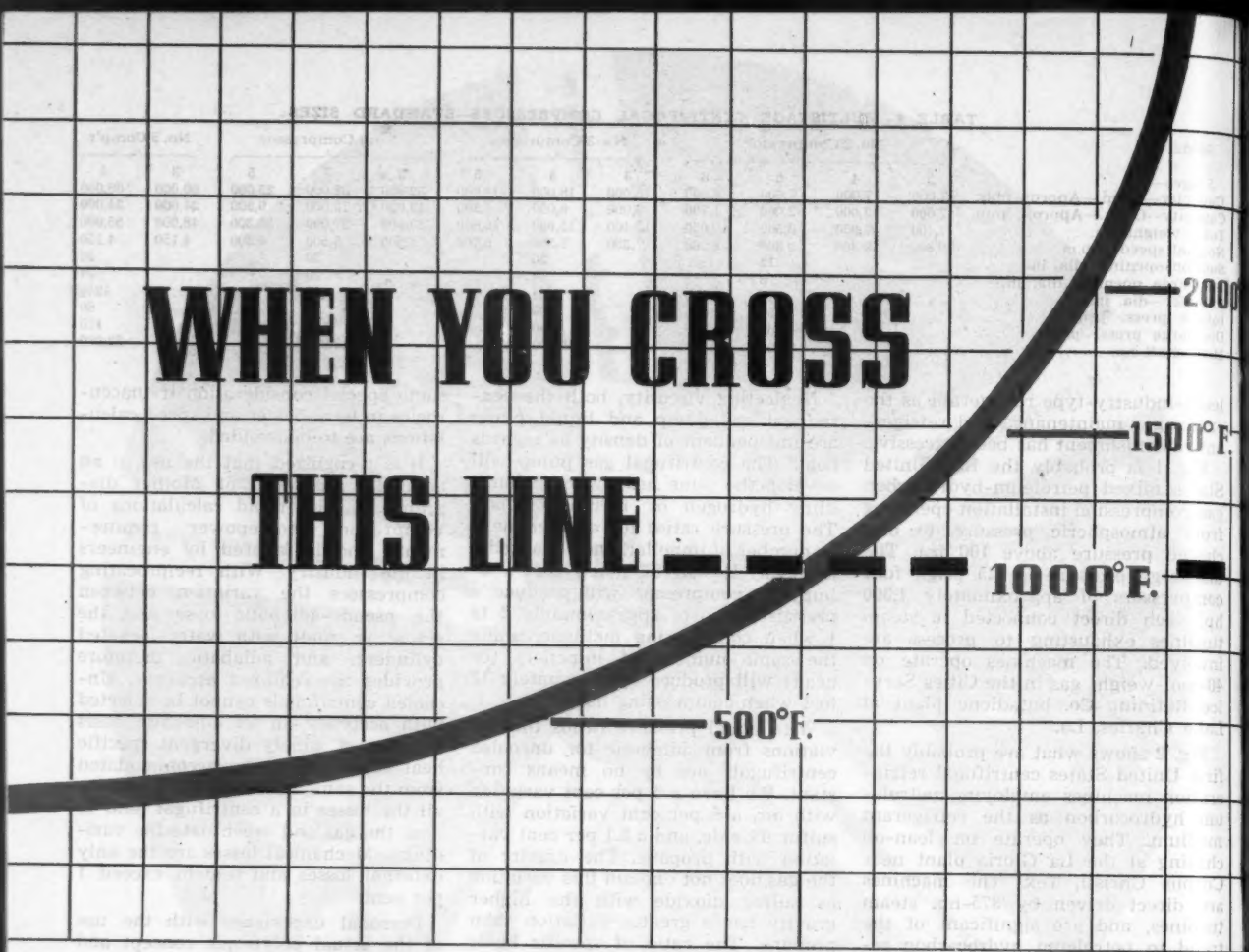


Fig. 2—These are probably the first United States centrifugal refrigeration machines employing petroleum hydrocarbon as the refrigerant medium. They operate on lean-oil chilling at the La Gloria plant near Corpus Christi, Tex.

WHEN YOU CROSS THIS LINE



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Production Problems Resulting from SALT DEPOSITION in Flowing Wells—An Investigation

by Robert D. Snow

The author since January 1, 1947, has been vice president of H.&S. Drilling Co., Tulsa, leaving Barnsdall Research Corp. to make his new connection. At Barnsdall he worked during 1946 as assistant to the chief research engineer. A graduate of University of Chicago, he also studied mechanical engineering at M.I.T. graduate school. Throughout the war he worked as aerodynamicist and flight-test engineer with Douglas and Consolidated Vultee Aircraft corporations.

1. Introduction

As a result of production problems which developed due to crystalline salt forming in Smackover wells at Eylau, Tex., and at the Patton field in southern Arkansas, a program of study was undertaken to determine the causes and, if possible, a means of preventing salt from being deposited in flowing wells. A method of producing the 2 Heilbron well at Eylau was recommended and production records kept to determine whether the salt problem had been overcome. In addition, several laboratory tests were made which were intended to indicate the most important factors causing plugging of wells with salt. The apparatus used in these tests and the results obtained are discussed in this report.

Investigation revealed that salt plugging of wells has occurred in many fields; a few of these fields are listed in order to illustrate the widespread occurrence of this problem. Salt problems have been encountered at Sugar Creek, Louisiana; Cotton Valley, Louisiana; Rodessa, Louisiana; Buckner, Arkansas; and Louden, Illinois.

Salt deposition may occur even though well-head grindouts show no water production. For instance, on pumping wells in the Holloway sand at Cotton Valley, fresh water has been dumped in the annulus occasionally during the past 3 years with good results, although no water has been reported in production from the wells. In view of the gradual decline in productivity that may result from salt plugging, it seems probable that many cases may have passed unnoticed or have been considered as normal decline.

2. Results and Discussion

A. Field tests.—In our experience, two Smackover lime producing areas, Patton, Arkansas, and Eylau, Texas, had given trouble with wells salting up in and about the well bore at the time this study was begun. Most of the trouble had been experienced at the 2 Heilbron which is the only producing well in the Eylau area, two offsets having been dry. Consequently, tests were started on the 2 Heilbron in an attempt

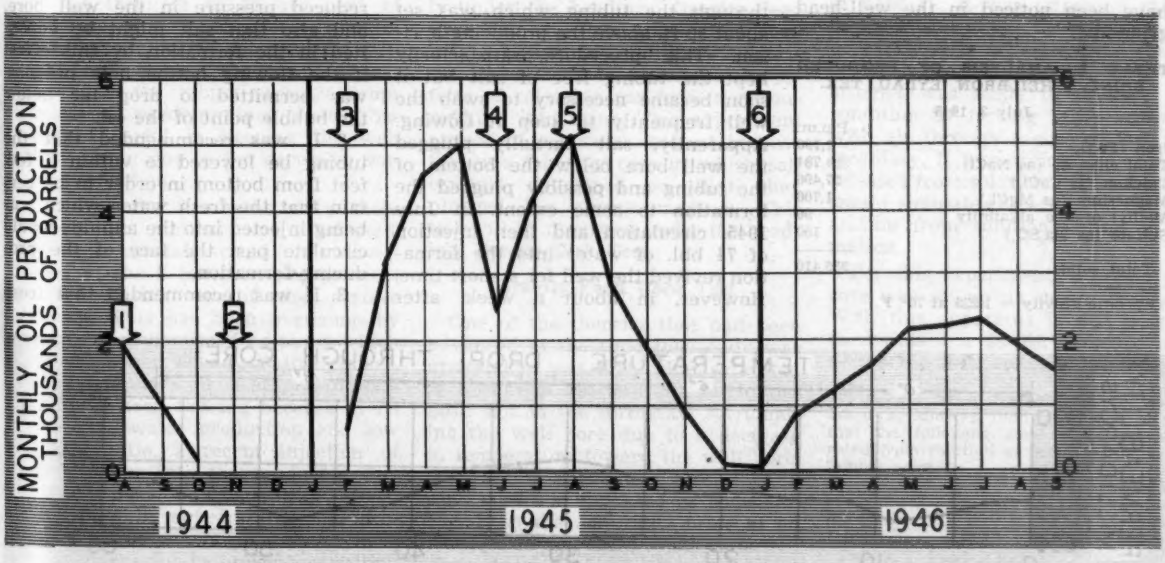


Fig. 1—Produced brine analysis for the 2 Heilbron. (1) Completed August 1944, 155 bbl. per day on ¼-in. choke, gas-oil ratio 8,050 cu. ft. per bbl. (2) Tubing and annulus salted up. (3) After workover, injection of water in annulus kept tubing free of salt. (4) Salt plugged well below bottom of tubing. (5) First injections of water into formation revived well but subsequent injections unsuccessful. (6) Workover: 1—Plastic plug reduced bottom-hole water. 2—Lowered tubing. (3) Began producing well on small choke

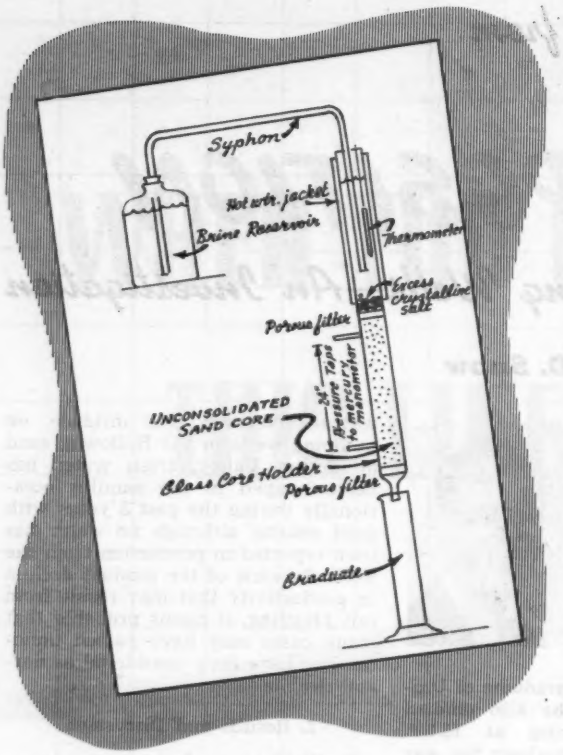


Fig. 2—Schematic diagram of gravity-feed core test

to develop producing techniques to prevent the well from salting up.

Table 1 presents a laboratory analysis of the brine produced at the 2 Heilbron. It should be noted that this is a concentrated brine carrying over 324,000 p.p.m. sodium chloride as compared with 360,000 p.p.m. for a saturated sodium chloride brine at 75° F. Occasionally, salt crystals have been noticed in the well-head grindouts.

TABLE 1—ANALYSIS OF PRODUCED BRINE, 2 HEILBRON, EYLAU, TEX.

July 3, 1945

	P.p.m.
Iron (Fe_2O_3)	1,190
Total chloride (as NaCl)	324,784
Calcium (as $CaCl_2$)	27,496
Magnesium (as $MgCl_2$)	1,700
Methyl orange alkalinity	90
Sulfate (as Na_2SO_4)	150
Total solids	355,410

Specific gravity = 1.235 at 70° F.

A review of the 2 Heilbron well history will be given in order to show the problems which have been encountered on this well and the progress that has been made toward overcoming these problems. The production record of the 2 Heilbron is shown in Fig. 1 with notations indicating the times that salt trouble occurred and the nature of the trouble.

In brief, the sequence of events has been as follows: The well was completed August 3, 1944, through perforations from 7,710 - 14 ft. and made 155 bbl. per day on a ¼-in. choke with a gas-oil ratio of 8,050 cu. ft. per bbl. In 2 months salt had plugged the tubing and then, when flowing through the annulus, salt quickly plugged the annulus, also. It was then necessary to pull and clean tubing and also to clean hole to bottom. At this time, an unsuccessful attempt was made to set a plastic plug to shut off bottom-hole water which had been about 10 per cent of the oil production. After this workover, equipment was installed to inject water into the annulus and circulate through the tubing which was set about 50 ft. above the producing horizon. This procedure satisfactorily kept the tubing free of salt but it soon became necessary to swab the well frequently to keep it flowing. Apparently, salt partially plugged the well bore below the bottom of the tubing and possibly plugged the formation to some extent. In July 1945, circulation and then injection of 74 bbl. of water into the formation revived the well for a short time. However, in about a week, after flowing through open tubing at rates as high as 421 bbl. per day, the well again died. A second water injection into the formation of 150 bbl. again revived the well for a period of about 2 weeks. However, five succeeding fresh-water injections, totaling 1,440 bbl., were unsuccessful in reviving the well for any length of time. By the end of 1945, well-head grindouts were averaging above 50 per cent water which, in combination with a reduced gas-oil ratio, made it impossible for the well to flow.

During February 1946 the well was worked over; the 15-ft. liner below 7,700 ft. was drilled out and two attempts were made to set a plastic plug in the bottom of the hole. Although no permanent fill-up was obtained with the plastic, the well-head grindout was reduced from above 50 to about 20 per cent when the well was recompleted. Gas-oil ratio after recompletion was 800 cu. ft. per bbl. as compared with 8,000 cu. ft. per bbl. when the well was first put on production in this zone.

After this recompletion, the salt problem was undertaken as a research project and three production procedures were instigated in an effort to overcome the salt troubles that had previously been encountered in this well.

1. It was recommended that the 2 Heilbron be flowed on a small choke (9/64-in.) at the rate of about 65 bbl. per day oil production in order to maintain a minimum bottom-hole-pressure drawdown. This was considered desirable because hydrocarbon gases absorb water vapor as they expand at reduced pressure. Therefore, it was reasonable to believe that salt might be deposited from brine by this drying effect at the reduced pressure in the well bore, and also that salt might be deposited in the formation by this effect if the flowing bottom-hole pressure was permitted to drop far below the bubble point of the oil.

2. It was recommended that the tubing be lowered to within a few feet from bottom in order to be certain that the fresh water which was being injected into the annulus would circulate past the face of the producing formation.

3. It was recommended that fresh

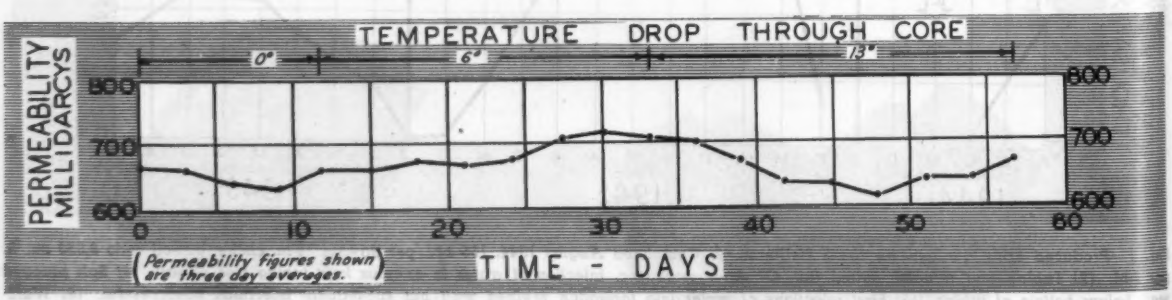


Fig. 3—Plot of core permeability, vs. time, for various values of temperature drop

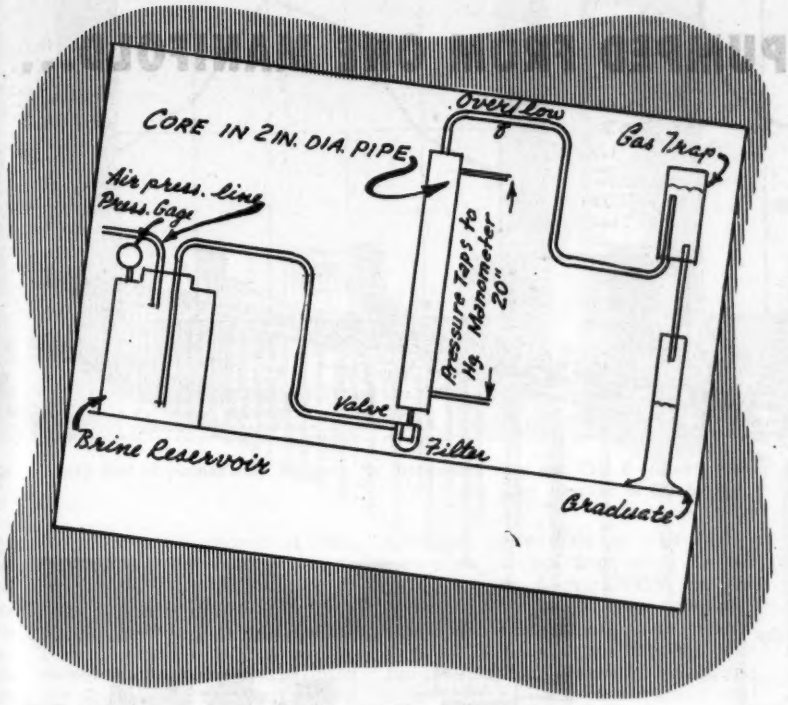


Fig. 4—Schematic diagram of pressurized core test

water be injected into the annulus continuously rather than intermittently because it was believed that much less water would be required to prevent the deposition of salt than to dissolve salt that might form between intermittent periods of injection. Also, there was less chance of inadvertently "killing" the well with continuous injection at a low rate than with intermittent injection at higher rates. Water injection has varied from 15 to 25 per cent of the rate of oil production. An automatic choke, which opens up the well and tends to clear the tubing of water when the tubing pressure drops below a predetermined level, has proved useful in keeping the well from dying due to the excessive water production.

During the 8 months since these production methods were adopted, no apparent salt trouble has developed at the 2 Heilbron except occasional salting up of the surface chokes. This has been overcome by means of a chemical feed pump which injects water ahead of the chokes. Although the well is at present difficult to keep flowing because of its excessive water production and low gas-oil ratio, a recent injection of fresh water into the producing formation had no beneficial effect. Therefore, it appears that the production methods outlined above have been successful in preventing salting up of this well.

B. **Laboratory tests.** — Tests were conducted in the laboratory to continuously observe permeability within a core while passing saturated brine through it. Methods were provided for independently varying the following factors within the core: (1) Temperature drop, (2) pressure drop, and (3) gas (liberated from solution): liquid ratio. It was anticipated that plugging of the core by precipitated salt would be recognizable as a decrease in permeability of the core. Two core tests were devised for this purpose and are discussed separately under the headings, **Gravity-Feed Core Test** and **Pressurized Core Test.**

In addition, a qualitative experiment was made to determine the effects of releasing gas from a porous medium into brine. This experiment proved of particular interest because this was the only case in which salt crystals developed so that they plugged the porous medium. This test will be discussed under the heading, **Porous Disk Test.**

Gravity-Feed Core Test

One of the theories that had been advanced at the time this study was undertaken was that brine, saturated at formation temperature, might deposit salt in the formation surrounding the well bore due to a decrease in temperature toward the well bore. In order to check this possibility, a sand core was mounted as shown in Fig. 2, so that saturated brine at an elevated temperature could be passed through the core which was kept at room temperature. Pressure drop across the core and rate of flow of the brine were recorded in order to obtain core permeability for extended periods of time at various values of temperature drop through the core.

Fig. 3 summarizes the results of this test and shows that no appreciable reduction of core permeability had occurred after passing supersaturated brine through this core for approximately 2 months. Apparently there was no tendency toward plugging of the core by the minute salt crystals which must have been precipitated by the reduced temperature in the core. Consequently, the theory that plugging of the formation surrounding a well bore may be due to a temperature drop near the well bore does not appear to be plausible.

Pressurized Core Test

Oil samples taken at Patton by the U. S. Bureau of Mines showed no free salt crystals. However, the oil samples did show a few small droplets of brine from which crystals of sodium chloride formed after evaporation. Gas samples carried water vapor in such quantities that it was estimated that an oil well producing 125 bbl. of oil daily from a gas-oil ratio of 2,000 cu. ft. per bbl. would carry ½ to 1 bbl. of water with the gas daily.

The theory was advanced by C. H. Riggs of the U. S. Bureau of Mines and by W. L. Horner that gas separating from oil or water due to the decreasing pressure toward the well bore might absorb sufficient water vapor to precipitate salt from the brine. Filtration and growth of the sparsely distributed salt crystals as they approached the well bore might cause plugging of the formation.

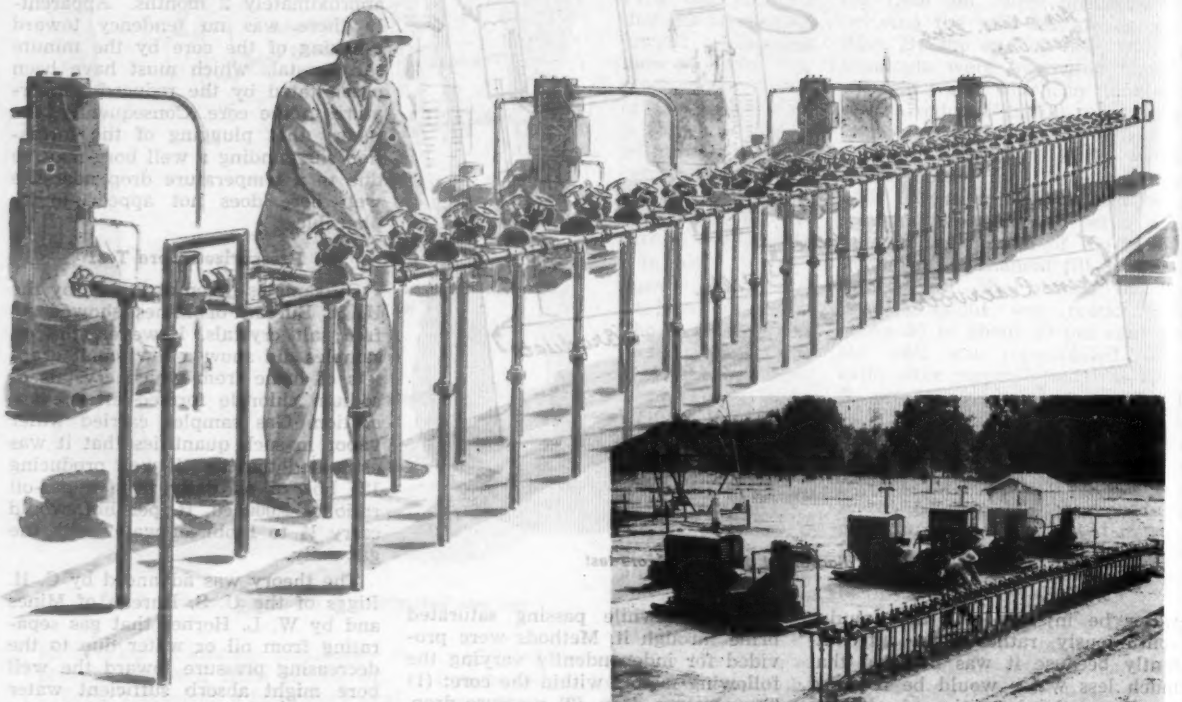
Using quantities likely to be experienced in flowing wells at a depth of 8,000 ft., it was estimated that 3 to 4 per cent of gas by volume might be expected to separate from the oil before it reached the well bore.* An attempt was made to produce this condition by forcing brine saturated with air through a core of low permeability. It was anticipated that air released from solution within the core would simulate the effect of gas separating from solution within a formation.

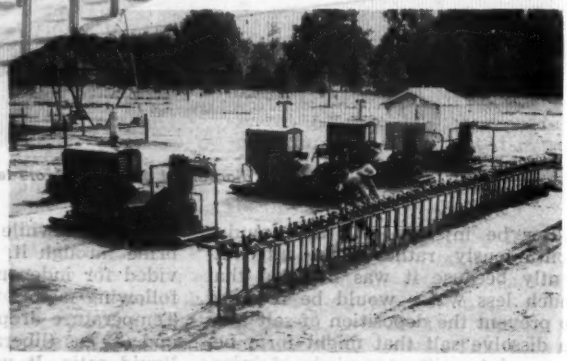
For this experiment, a pressurized core was set up as shown in Fig. 4. With this apparatus it was possible to maintain a 20-psi. pressure drop across the 2-ft. core. As in the pre-

*Analysis of a bottom-hole oil sample taken at Midway field, Arkansas, showed that the following amounts of gas separated from solution at pressures below the bubble point:

Pressure drawdown below bubble point	Volumetric per cent of gas liberated from solution
100 psi.	1.0
200 psi.	1.8
300 psi.	3.3
400 psi.	5.0
500 psi.	6.3

38 WELLS PUMPED FROM ONE MANIFOLD...





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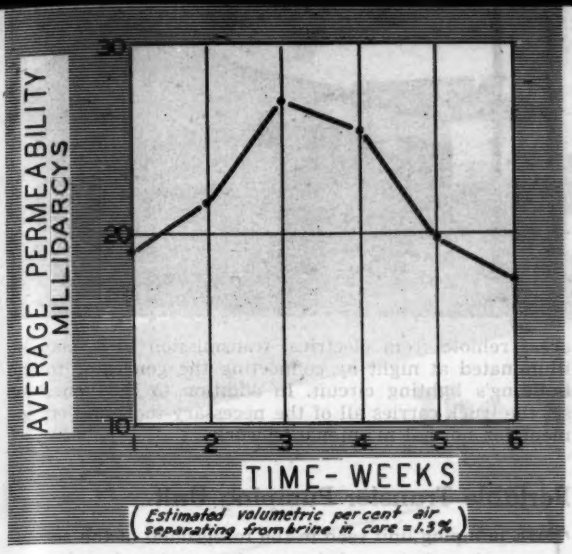

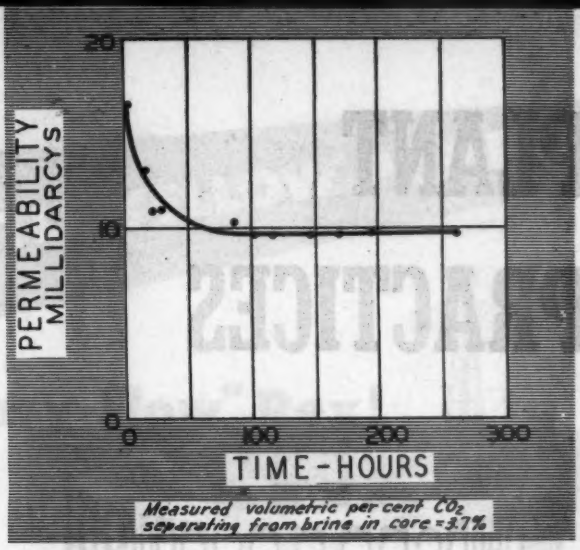

Fig. 5—(Left) Plot of permeability vs. time, for pressurized core test. Fig. 6—(Right) Plot of permeability vs. time, for pressurized core test after injection of CO_2

vious experiment, a record of core permeability was kept in order to determine whether salt was being precipitated and plugging the core. The results of this test are plotted in Fig. 5. Although a gradual decline in core permeability was noted after the third week, no signs of salt plugging were detected when the core was examined after the sixth week. Probably the declining permeability was due to plugging of the core by rust particles in the brine out of the iron reservoir. It was found that a small amount of rust developed in the tank even though the brine was treated with 2,000 p.p.m. of sodium chromate.

No measure of the separated gas was made; but from the solubility of air in brine, it was estimated that about 1.3 per cent of the air by volume was separating from the brine within the core. Since no salting effects were observed in this test, it was decided to increase the amount of gas coming out of solution in the core by charging the reservoir with CO_2 which is much more soluble than air. Pressure in the reservoir was then maintained with air. The amount of gas separating in the core was measured by means of a gas trap, and with this arrangement it was found that 3.7 per cent gas by volume was separating in the core.

Permeability figures were recorded as before and Fig. 6 summarizes the results. During the first day an appreciable drop in permeability occurred but for the next 10 days no change was observed. At the conclusion of this test fresh water was forced through the core to determine whether the original permeability would be restored by solution of salt in the core. Since fresh water did not increase the permeability of the core, it was concluded that the reduced permeability was due to rust particles which had accumulated in the brine system.

Although it would be desirable to continue these tests at still higher per cents of gas separating in the core, it may be concluded on the basis of these tests that salt, precipitated in a formation by separation of gas, does not readily plug the formation. Apparently unless salt is precipitated in such a manner that it adheres to the formation, plugging is unlikely because of the microscopic size of the crystals formed.

Porous Disk Test

A crude test was devised to simulate the effect of dry gas flowing into a well bore filled with brine. For this purpose, dry air was blown from the bottom of a test tube through a porous disk into brine which filled the upper part of the test tube. With the disk in a nearly vertical position salt crystals soon formed on the dry side of the disk and reduced its permeability considerably. The appearance of the salt accumulation indicated that brine was continually being drawn into the porous disk by capillary action and then evaporated by the dry air, thereby precipitating salt which plugged the pore space in the disk. Having plugged the disk in this manner, the brine was removed and replaced with fresh water. It was observed that the fresh water soon dissolved the salt crystals and restored the permeability of the disk. It is concluded that in a well producing saturated brine the gas zone will tend to plug itself with salt in the manner outlined above unless sufficient fresh water is circulated past the face of the formation.

3. Conclusions

1. Salt plugging in wells is apt to occur wherever large quantities of gas are being released from solution or expanded. For this reason, in high-pressure flowing wells the first indication of salt troubles usually is the salting up of the surface choke or the flow line near the choke. Later, unless remedial steps are taken, salt plugging may occur in the tubing or even below the tubing.

2. Salt plugging within a formation is considered possible as a result of evaporation of brine by gas separating from oil at the reduced pressure near the well bore. Filtration and growth of sparsely distributed crystals as they approach the well could cause plugging of the formation near the well bore. However, since this plugging effect was not observed in the laboratory with reasonable quantities of gas separating from brine, it appears that most of the salt plugging in wells can be expected to occur within the well bore.

3. Salt plugging of a zone producing gas into a well bore filled with brine appears likely due to evaporation of the brine as it is drawn into the formation by capillary action. Plugging of this type can be prevented by circulation of fresh water past the face of the formation.

4. Salt depositions due to temperature differences within a well are considered negligible as compared with the effects which are due to evaporation of brine by produced gas.

5. Although salt plugging in wells may add to production headaches, no insurmountable difficulties are anticipated in the operation of wells of this type. Fortunately, it appears that salt plugging is most likely to occur in or sufficiently near the well bore that it is subject to the simple treatment of dissolving with fresh water.

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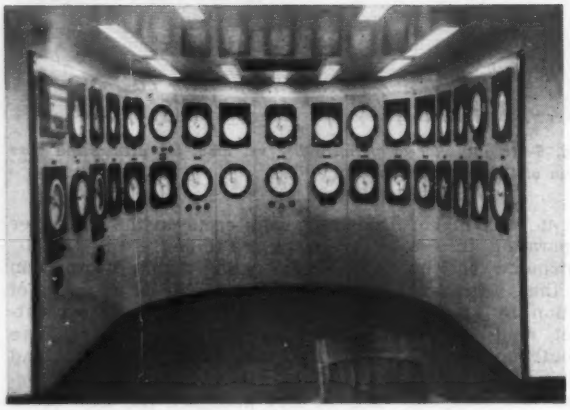
Acknowledgment

The author wishes to express his gratitude to Barnsdall Oil Co. for permission to publish this report, and specifically to thank John T. Hayward and W. L. Horner for their assistance in its preparation.

PLANT PRACTICES



Instrument Panel Arranged For Convenient Visibility

THE instrument panel shown in the photograph is arranged so that the operator may view all of the instruments from a nearly uniform distance without leaving his position at his desk. This view shows only one half of the control room. The other section of the room is arranged similarly and the operator's desk is positioned midway between the two panels. Indirect lighting reduces glare to a minimum.

Mobile Maintenance Equipment For Night-Time Operations

EQUIPPED with a 4,000-watt gasoline motor-generator unit which provides current for various kinds of electrically driven maintenance tools and for lighting, the pickup truck shown in the photograph is used for servicing field stations and the like. Such installations as that shown in the second photograph which are located in

areas remote from electrical transmission lines may be illuminated at night by connecting the generator to the building's lighting circuit. In addition to the generator set the truck carries all of the necessary tools and equipment for normal maintenance work.

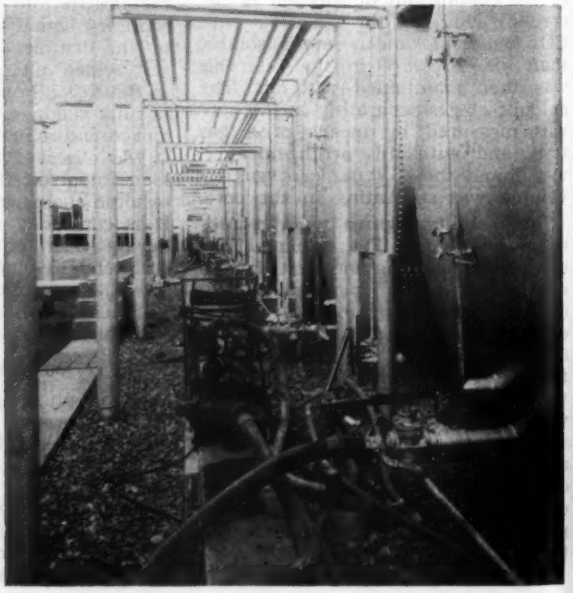
Portable Transfer Pumping Unit

THE pumping unit seen in the foreground of the accompanying photograph is one of several such units employed in the Lyman, Okla., plant of Skelly Oil Co. for product transfer service. Mounted on four wheels which run on a concrete track the pumping unit may be connected to any of the storage tanks in the battery which it serves.

Connection to loading and unloading lines to the tanks is made by flexible hose which is provided with a standard union. Each of the terminal connections for the tanks and for the other lines is located near ground level and are provided with catch basins which drain into the plant's sewer system. Made of short lengths of 8-in. pipe and extending 6 in. above grade these catch basins simplify the job of housekeeping in the area. In order to avoid product contamination when changing the pump from one service to another the unit is flushed out by disconnecting both flexible hose lines and discharging the material in the pump to a catch basin.

Drains which connect to the sewer system are also installed in the concrete track or runway for the pump. The track is approximately 18 in. wide and has its center portion elevated above the surface on which the unit's wheels are placed. This center part of the track serves as a guide for the wheels and its height is slightly below the wheel's axle. Bearing surface for the wheels is approximately 3 in. wide.

Suitable plugins are placed at convenient intervals along the trackway such that the feed line to the pump's motor is maintained to relatively short lengths.



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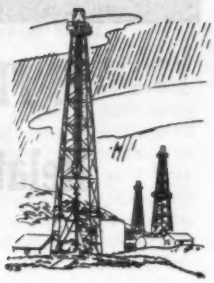

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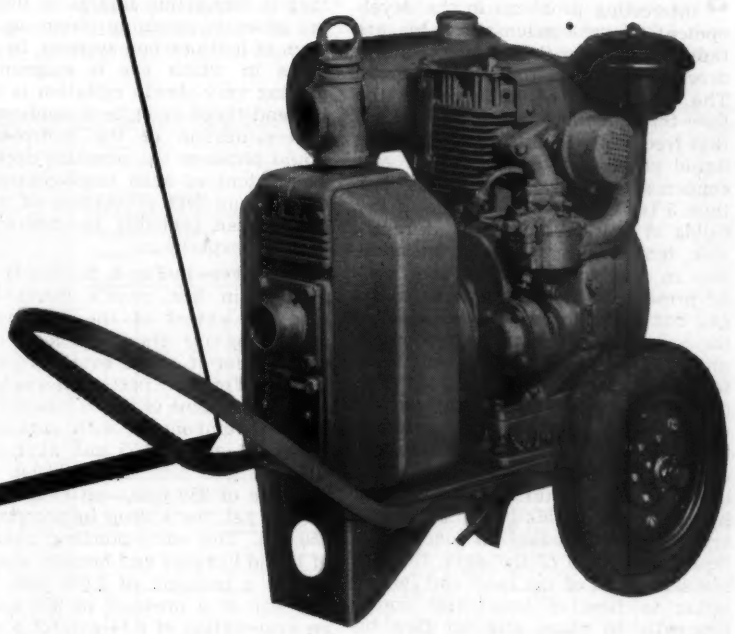

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Gas-Condensate RESERVOIR Engineering

2. Fluid Properties and Flow Relationships in the Reservoir

by C. Kenneth Eilerts *

This is the second of three articles relating to the uses of information on the properties of gas-condensate fluids in the solution of reservoir-engineering problems. The first article, published in last week's issue, dealt with the reserve fluid, its composition and phase behavior. The final article treats equilibrium factors, hydrates, and corrosion, and will be published in an early issue. The articles are the outgrowth of a number of years of experimental research in the laboratory and field, and were prepared to show the trends and significance of technique developments rather than to review what has been accomplished.

SOME of the most important and interesting problems in the development of gas-condensate fields are those relating to the recovery of hydrocarbon liquids from the reservoir. The production of oil involves the flow through the formation of a fluid that frequently is entirely liquid. The liquid phase of most samples of gas-condensate fluids, however, is less than 5 per cent of the volume of the fluids at any pressure and at reservoir temperatures. Liquid, in addition to this volume proportion, may be present in the reservoir with the gas but such liquid will be held in the complicated network of sand pores until properties of the flowing fluid favorable to its release prevail. For convenience in presenting the factors relating to the recovery of hydrocarbons that may be liquid in the reservoir, the discussion is presented under the topics: (6) The recovery of hydrocarbon liquids with lean reservoir fluids including (a) concepts of liquid saturation of the sand, (b) liquid saturation of the sand and its relation to flow of interstitial liquid originally in place, and (c) flow of liquid that may form by retrograde condensation; and (7), the recovery of rich gas-condensate fluids that may have critical temperatures in the range of reservoir temperatures and hence are in a single, liquid-like phase in the reservoir.

6. Recovery of Hydrocarbon Liquids Associated with Lean Fluids in Reservoirs

As already stated, the majority of gas-condensate fluids contain less than 4 gal. of butanes per 1,000 cu. ft. of gas. Liquid precipitated in the reservoir from these lean fluids will be held in the pores of the formation unless it can flow toward the producing wells with gas or is subsequently vaporized as the reservoir pressure declines. The possibilities for recovering the liquids by evaporation are not promising. Laboratory investigations indicate that thorough agitation of liquids and gases is important in vaporizing liquids or dissolving gases in attaining phase equilibrium of hydrocarbon systems. In sand pores in which gas is stagnant or moving very slowly agitation is lacking and there must be a tendency to supersaturation of the hydrocarbon liquid phase as the pressure declines. The extent of such displacement of equilibrium and prevention of evaporation can probably be determined only by experiment.

The curves in Fig. 2, Section B (See Part 1, in last week's issue) indicate the extent of the evaporation of a reservoir fluid (Table 1) that could occur if phase equilibrium did prevail. For this particular reservoir fluid the volume of liquid butanes and heavier components with each 1,000 cu. ft. of gas is 0.65 gal. at a pressure of 1,000 psia. and 0.47 gal. at a pressure of 250 psia.—an evaporation of 0.18 gal. for a drop in pressure of 750 psi. The corresponding volumes of liquid hexanes and heavier are 0.59 gal. at a pressure of 1,000 psia. and 0.45 gal. at a pressure of 250 psia.—an evaporation of 0.14 gal. for a drop in pressure of 750 psi. If the pressure were decreased to 100 psia. before the reservoir was abandoned, not more than 0.24 gal. of condensed butanes and heavier could be vaporized from the pores of the formation and that amount only on the doubtful assumption that equilibrium would prevail between the hydrocarbon phases as the pressure declined.

There is the possibility that condensed liquid will flow through the formation with gas provided the pore spaces are adequately saturated with liquid. Fig. 3 was prepared as a part of a preliminary investigation of those characteristics of fluids and permeable sands that govern liquid flow. The data of Botset[1] on the flow of gas and liquid through a consolidated sand were used to provide values of "per cent specific permeability" corresponding to given liquid saturations of pore volumes for the equation

$$v_l/v_g = (k_l/k_g)\ (\mu_g/\mu_l) \qquad (1)$$

where

v_l/v_g = ratio of the volumetric rates of flow of liquid and gas through the formation, the phase volumes being measured at the pressure and temperature of the formation

k_l = per cent specific permeability of a sand to liquid phase[2]

k_g = per cent specific permeability to gas phase

μ_g = viscosity of the gas phase, and

μ_l = viscosity of the liquid phase

The relative volume of the liquid phase is defined as the volume of the flowing liquid phase at flow pressure and temperature divided by the volume of the flowing fluid (gas and liquid phases) at the same pressure and temperature. The relative volume may be readily computed from the liquid-gas ratios illustrated in Figs. 1 and 2. (See Part 1.) The ratio $v_l : v_g$ approaches the value of the relative volume of the flowing liquid phase as the values of both quantities decrease. Values of the relative volume may be substituted in Equation 1 for the ratio $v_l : v_g$ when relative volumes are 0.01 or less.

The data of Botset were obtained by measuring the steady-state flow characteristics of water and carbon dioxide gas in a consolidated sandstone having an average permeability of 0.495 darcy. The solid line curves of Fig. 3 were prepared on the assumption that the specific permeability ratio ($k_l : k_g$) and the determined liquid-saturation relation could be applied to the flow of two-phase hydrocarbon fluids through consolidated sands of other permeabilities. The ratios of phase viscosities ($\mu_g : \mu_l$) used in preparing the curves range from 1.0 to 0.01. The value 1.0 is applicable to the substantially identical

*Senior physical chemist, Bureau of Mines, Bartlesville, Okla. Published by permission of the Director, Bureau of Mines, U. S. Department of the Interior.

phases of a rich gas-condensate fluid which has a critical temperature equal to reservoir temperature, while 0.01 is believed to be as low as any value that likely will apply to gas-condensate fluids.

The data plotted in Fig. 3 were obtained in the Bureau of Mines laboratory with improvised apparatus by driving a hydrocarbon condensate out of consolidated sand cores by means of air at low pressures and atmospheric temperatures. As a first step the clean, extracted cores were saturated with hydrocarbon liquid by evacuating them while they were suspended in a vessel above some frozen condensate and then causing them to fall into the liquid phase of the condensate before air at atmospheric pressure was admitted to the vessel. The cores filled with condensate were permitted to drain by gravity and then weighed. The difference between the weight of a core before it was filled with condensate and the weight afterward at any subsequent experimental stage provided means of estimating the per cent liquid saturation. Measured quantities of air were passed through the cores at low rates of flow to remove the condensate. The volume of liquid phase removed from the core and the volume of air required to remove it (all volumes at the pressure and temperature of flow) provided the data for computing the ratios of the volumes of the phases of the flowing fluid. The characteristics of the three cores tested are given in the legend of Fig. 3. The viscosity of the condensate used was 0.910 centipoise, and the average viscosity of the air was 0.0185 centipoise; therefore, the value of the viscosity ratio, $\mu_g : \mu_l$, was 0.0203.

The flow tests on a core were made in successive steps until most of the liquid had been removed and the ratios of liquid volumes removed to air volumes used were considerably lower than ratios that would be practicable for use in recovery of liquids from reservoirs. The test method employed did not provide a fluid entering the cores identical in liquid-gase ratio with the fluid leaving the cores and in that respect the flow studied was but an approximation of steady-state flow. However, the results were sought for guidance in the design of procedures and apparatus for later more accurate investigations and they seem to indicate the possibility of an extension of the range of steady-state flow data like those of Botset.

Most gas-condensate fluids have low liquid-gas ratios as compared with fluids from oil wells, therefore, relative-volume and liquid-saturation data are needed in the range of low, relative volumes. The data obtained on the three cores in the range of low relative volumes did not agree too well with the curves shown for the data of Botset[1] obtained on a consolidated sand, but they agree with a similar family of curves (not shown) prepared from the data of Wyckoff and Botset[2] on unconsolidated sands. Because of grain-size distribution, degree of cementation, extent of bedding planes and other features, consolidated sands may have characteristic permeability-saturation curves. The differences in the results illustrated in Fig. 3 for flow in consolidated sands may be real differences, and the slopes of curves like those shown are probably as significant an engineering consideration as the positions of the curves with respect to the per cent-liquid-saturation scale. The data obtained have served a useful purpose in indicating trends and the flow characteristics that may be expected at low relative volumes of the liquid phase in flowing fluids.

The two examples that follow indicate possible uses of data such as are shown in Fig. 3 in the solution of problems relating to the flow of liquid through formations with gas when the liquid-gas ratio measured at the surface is of the order of 4 gal. or less of butanes and heavier components per 1,000 cu. ft. of gas.

Determination of Liquid Saturation of the Reservoir Sand

By the use of an applicable set of curves of the type illustrated in Fig. 3 the liquid saturation of the sand adjacent to the well can be estimated if liquid in a measured proportion with gas is flowing into the well bore and if the viscosities of the gas and liquid phases in the reservoir can be determined. Assuming a reservoir pressure of 2,400 psia., a reservoir temperature of 200° F., and a fluid compressibility factor of 0.89, fluid having a volume of 1,000 cu. ft. when measured at a pressure of 14.4 psia. and a temperature of 60° F. will have

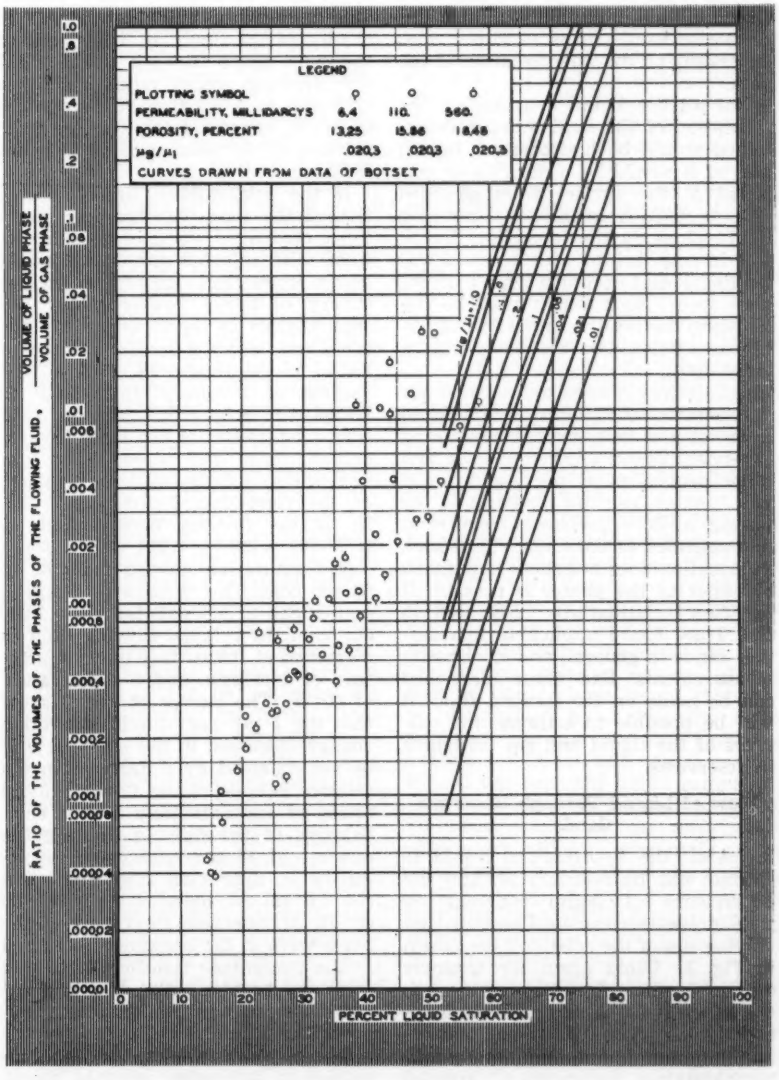

Fig. 3—Relative volumes of the gas and liquid phases of the fluid, and liquid saturation of the consolidated sand through which it flows

a volume of 6.77 cu. ft. in the reservoir. If liquid in the amount of 0.5 gal. (0.067 cu. ft.) is flowing through the reservoir as a part of fluid having a volume of 6.77 cu. ft., the relative volume of the liquid is 0.067/6.77 = 0.0099.

Equipment is now available for obtaining data like those used in the above illustration. Additional equipment must be designed and developed for measuring the viscosities of the gas and liquid phases at the pressures and temperatures of flow through formations. The following values of data are used for the purpose of illustrating the application of such equipment. Assuming viscosities of 180 micropoises for the gas phase and 6,000 micropoises for the liquid phase, the ratio $\mu_g : \mu_l$ will have the value of 0.03. Referring to the family of curves in Fig. 3 the liquid saturation for a relative volume of 0.0099 and a viscosity ratio of 0.03 is 69 per cent. If the plotted data are used, the indicated liquid saturation of the pores in the formation would be 40 to 55 per cent, depending on the interpretation of the data.

Not all the liquid constituting the saturation of the sand thereby determined would be hydrocarbon liquid; part of it would be water. Water collected at the surface from gas-condensate wells frequently was not in a liquid phase in the formation[3] but it was in equilibrium with a liquid water phase that occupied a part of the pore space. Such water must be determined[4] before the saturation of hydrocarbon liquid in the pores can be estimated.

Satisfactory means are needed for determining the volumes of liquid hydrocarbons in reservoirs containing two-phase fluids. The composition and other properties of coexistent reservoir phases can be determined by testing a fluid prepared from samples collected at the surface[5], but such information does not show how much of either of the phases is present. If the flow relationships illustrated in Fig. 3 are found applicable to reservoir sands in general, and if viscosity measurements like those described can be made on the flowing fluid, it will be possible to estimate the volumes of the liquid and gas contained in reservoirs.

Flow of Liquid Through Reservoir Sand

Not all the hydrocarbon liquid in a sand will be recoverable, and the dependence of liquid recovery on fluid properties can be illustrated by another use of the relationships shown in Fig. 3. Using again the example of the two-phase fluid flowing through the formation (the relative volume of the liquid being 0.0099) and assuming that the reservoir pressure will be maintained by means of injected gas, consider what will happen to the liquid saturation of the sand pores as the injected gas moves toward the producing wells. The injected gas eventually will dilute the flowing reservoir fluid and progressively lower the relative volume of the liquid phase moving with the gas. With reference to the curves of Fig. 3, the ratio of gas and liquid viscosities ($\mu_g : \mu_l$) would change somewhat, probably to lower values. Assuming, however, that the ratio remained equal to 0.03, the liquid saturation of the sand pores would decrease continuously as the relative liquid volume of the moving fluid decreased, and the original liquid saturation of 69 per cent would approach 58 per cent as the relative liquid volume changed from 0.0099 to 0.001. According to the curves of Fig. 3, a volume of hydrocarbon liquid and interstitial water equal to 11 per cent of the pore volume of that part of the formation swept by injected gas would be carried to the producing well as the moving reservoir fluid was diluted until its relative liquid volume was one-tenth the original value. Recovery of the liquid in 5 per cent of the pore space through which fluid was flowing would require dilution with gas to a relative liquid volume of 0.0036, approximately one-third the relative liquid volume of the original fluid.

If the hydrocarbon liquid saturation of the sand was decreased only 1 per cent by dilution of the flowing fluid with injected gas, there would be an appreciable increase in the recovery of heavy hydrocarbons. For such change in liquid saturation the fractional increase in the volume of liquid phase recovered with a unit volume of flowing fluid would be $1/(100 - S)$ where S is the per cent liquid saturation of the sand (hydrocarbon liquid and water). The volume of liquid displaced from the pores of the formation for each 6.77 cu. ft. of the flowing fluid would be $6.77/(100 - 69) = 0.218$ cu. ft. for a liquid saturation change from 69 to 68 per cent. This volume of liquid is equivalent to 1.6 gal. for each 1,000 cu. ft. of the original flowing fluid as measured at the surface under a pressure of 14.4 psia. and a temperature of 60° F. The curves of Fig. 3 show that the 1 per cent liquid saturation change discussed in the example will be accompanied by a decrease in the relative volume of the flowing liquid phase of approximately 20 per cent. Dilution of the flowing fluid in the amount of 20 per cent could be effective in displacing from the pores the 1.6 gal. of liquid for each 1,000 cu. ft. of reservoir fluid only if the pores were in the beginning saturated to the percentage required for liquid flow and provided also that the liquid displaced was predominantly hydrocarbon liquid.

It is a problem in engineering economics to determine whether recovery of reservoir liquid phases by decreasing the liquid saturation of the pores will justify the injection of the amount of gas necessary to bring about the required flowing fluid dilution. The volume of gas that would have to be injected to bring about the cited changes in the relative liquid volume at reservoir pressure and temperature would be dependent on the properties of the phases in the reservoir and also on the distribution of the flow channels in the formation as previously discussed.

Possibilities for Future Liquid Flow in Formations Found by Test to Contain a Single-Phase, Gaslike Fluid

The applications of the concepts of Fig. 3 are intended for those reservoirs in which a two-phase hydrocarbon fluid is known to be flowing toward producing wells. If tests show that the fluid in a newly discovered reservoir is in a single gas-like phase, it may not be wise to allow the reservoir pressure to decline with the expectation that a liquid phase formed by retrograde condensation will flow to the producing wells with the gas. If the pores of the formation originally contain only gas, they would have to be filled partly with hydrocarbon liquid before any of it would flow. If the pores contain enough water, the precipitation of condensate probably would induce liquid flow but the liquid that flowed might be only water. There is the possibility that a certain volume of condensate might simply displace hydrocarbon fluid and water from the pores and remain within them as a dispersed phase. Leverett[6] showed that water will displace oil from a sand until the pores contain approximately 80 per cent water and 20 per cent oil but that additional oil will not be removed from the sand, although the fluid flowing through it consists of 100 per cent water.

The "equilibrium saturation"[3] that develops when water is used to displace hydrocarbon liquid from sands doubtlessly would be altered if a gas phase were passed through the sand. On the basis of the relative phase volume and liquid saturation relations illustrated in Fig. 3 it seems probable that, if the flowing fluid were predominantly gas, both the condensate and water saturation of a sand could be reduced to relatively low values. However, where it is not feasible to inject gas and maintain the original reservoir fluid in a single phase to prevent condensation, it probably would not be practicable to cycle at lower pressures the quantities of gas that would be required to recover the precipitated condensate.

It seems possible that a hydrocarbon liquid phase may be present in some gas-condensate reservoirs, despite the evidence furnished by certain tests that the fluid in them is a single gas-like phase. If this is

true, a part of these particular formations also may be saturated with hydrocarbon liquid to the extent that should pressure be allowed to decline, all or part of the liquid subsequently condensed in the reservoir would flow toward the producing wells with gas. It is of importance to know whether hydrocarbon liquid can be recovered from such reservoirs without the expense of maintaining the reservoir pressure by the injection of gas and without undue loss of the heavy liquid components in the pores of the formation.

Assuming that current conceptions of the sampling of reservoir fluids are correct, flow tests made at a gas-condensate well by means of portable equipment[7] should indicate the phase state of the fluid. A lean fluid in a reservoir will be found to be present either in two phases or in a single gaslike phase with a dew-point pressure less than reservoir pressure. If gas and liquid phases are present, a sample will be obtained which has a dew-point pressure at reservoir temperature equal to reservoir pressure (within the limits of experimental accuracy), or greater than reservoir pressure. A dew-point pressure greater than reservoir pressure is definite evidence that liquid flowed to the well from the parts of the formation under full reservoir pressure as the fluid sample was being taken. A dew-point pressure equal to reservoir pressure indicates that liquid hydrocarbons may be present in the reservoir but that they did not flow toward the producing well from which the sample was taken. A dew-point pressure less than reservoir pressure is considered proof that the fluid in the reservoir is in a single gaslike phase and that there is no hydrocarbon liquid saturation of the sand.

The results of Bureau of Mines tests made at flowing wells show for seven single-phase reservoir fluids that the reservoir pressures exceeded the dew-point pressures at reservoir temperatures by an average of only 152 psi. and in no case by more than 300 psi. The dew-point pressures measured ranged from 2,946 to 4,900 psia. and are estimated to be accurate to ± 25 psi. Reservoir temperatures ranged from 191° to 251° F. It does not seem likely that this close agreement between reservoir and fluid dew-point pressures for seven reservoirs is only coincidental. The original pressure of a gas-condensate reservoir depends on factors associated with the origin, accumulation, and retention of petroleum hydrocarbons, but the reason for the agreement between dew-point and reservoir pressures must be latent in substances associated with dew-point phenomena; the presence of a liquid phase in the reservoir would be an explanation.

The liquid phase may not be in the immediate vicinity of the test well but down dip or on the flanks of dome-like structures. The fundamentals of heterogeneous flow, illustrated in Fig. 3, impose no limitations on gravitational segregation of the phases. However, even with geologic time available for migration, some liquid hydrocarbons could be retained in the higher parts of a formation to saturate significantly the pore spaces within them. Furthermore, when the flow of fluid in the reservoir is induced by withdrawals through wells high on the structure, an increase in the liquid saturation by retrograde condensation of hydrocarbons might provide liquid flow.

If both gas and liquid hydrocarbon phases are present in reservoirs, it would seem that accurate samples of the reservoir fluid invariably would have dew-point pressures equal to or greater than reservoir pressures. The requirements for phase equilibrium appear to be satisfied, and a sample of the reservoir vapor phase should, in a container at reservoir temperature, exhibit a dew point when the pressure is lowered by the least decrement. Unless the consistently small differences in the reservoir and dew-point pressures (averaging 152 psi.) are found to be indirect evidence of a liquid phase, it would seem to be evident that at the time of the tests the hydrocarbon fluids were present in the reservoirs as a single (gaslike) phase with no assurance of hydrocarbon liquid saturation of the pores of the formation.

On the basis of present knowledge and with available testing techniques, the only way to determine if the hydrocarbon liquid saturation of a sand is great enough to permit the flow of condensed liquid is by trial. If tests at flowing wells show that the dew point of the fluid moving in the reservoir is equal to or less than reservoir pressure and there is no evidence of a flowing liquid phase, then the only alternative is to allow the reservoir pressure to decline far enough to ascertain if liquid obtained by retrograde condensation will flow or be retained in the sand. The risk of losing condensate by such a procedure, if the hydrocarbon liquid saturation of the sand should be less than the required percentage for flow, is evident. There is a real need for more factual information on this subject which has important economic significance.

7. Recovery of Rich Gas-Condensate Fluids from Reservoirs

Comparatively few of the discovered reservoirs contain gas-condensate fluids with liquid-gas ratios greater than 4 gal. (butanes and heavier components) per 1,000 cu. ft. of gas. However, the reservoir phase state of a rich fluid may differ significantly from that of a fluid that is less rich in heavy hydrocarbons, and it is of interest to consider how the phase characteristics of a rich fluid are related to the possibilities for its flow through the formation.

Olds, Sage, and Lacey[8] have estimated, on the basis of experimental investigations of six mixtures of liquid and gas from the separator at a gas-condensate well, that a mixture composed of approximately 40 weight per cent gas and 60 weight per cent separator liquid (a mixture containing 12 gal. of butanes and heavier components per 1,000 cu. ft. of gas) would have a critical temperature equal to the temperature (235° F.) of the reservoir sampled. Therefore, reservoir fluid containing only slightly more separator liquid would exhibit a bubble point rather than a dew point when the original reservoir pressure was decreased until the fluid was in two phases.

A fluid with a bubble point at reservoir temperature would behave in some respects like undersaturated oil in a petroleum reservoir but, being at a temperature near the critical temperature of the mixture, it would have gas and liquid phases with nearly identical properties. With reference to Fig. 3, the ratio of gas and liquid viscosities, $\mu_g : \mu_l$, would be approximately 1.0 at phase boundary pressure and would decrease as pressure decreased along the channels of flow. In the beginning, liquid saturation of the pores would probably be 100 per cent but as soon as two-phase flow began the phenomenon of "equilibrium saturation"[9] would develop and a part of the liquid would be expelled from the sand pores by gas that accumulates in them due to the Jamin effect.

If dry gas is not injected into the reservoir to maintain its pressure and the pressure is allowed to decline normally as hydrocarbons are produced, the volume of the flowing liquid relative to the volume of the flowing fluid would decrease. After the two-phase fluid flowed through the sand for a time the liquid saturation of the sand would decrease also. The ratio of phase viscosities, $\mu_g : \mu_l$, would continue to decrease with pressure, however, and the per cent liquid saturation of the sand attained at the lowest possible relative volume of the flowing liquid phase would probably be determined by a viscosity ratio similar to the one used in a previous example, $\mu_g : \mu_l = 0.03$. As shown by Fig. 3, the per cent liquid saturation of a sand required for flow of liquid is lowest when the gas and liquid phases are alike in properties; with this point in consideration, perhaps some recovery advantage would result from maintaining pressure on the rich hydrocarbon mixture by injecting gas into the reservoir.

A gas-condensate fluid having a critical temperature in the range of reservoir temperatures would be a fluid unusually rich in heavy hydrocarbons but having an average molecular weight less than those of fluids from petroleum reservoirs. Rich fluids

with critical temperatures in the range of atmospheric temperatures and exhibiting dew-point phenomena when reservoir pressures decline also would be expected to exhibit characteristics of flow unlike those of the lean and much more common gas-condensate fluids.

A satisfactory method for computing the critical temperatures and pressures of gas-condensate fluids from their compositions has not been discovered or at least none has been made generally available. At present it seems that one of the best methods of determining the critical state of fluids is to measure the properties of the liquid and gas phases experimentally. The Bureau of Mines has developed a windowed cell[9] which permits a view of the phases of a fluid and visual measurements of their volumes at high pressures and low temperatures. Previously an equilibrium cell was used to measure the compressibilities of gas-condensate mixtures and a pressure-temperature-composition concept was evaluated by treatment of the experimental data that had some of the characteristics of the critical state. The concept was referred to as "max P_t"[10] and was the maximum phase boundary pressure with temperature constant and composition variable as indicated by a series of eight mixtures of separator gas and liquid. Figs. 1, 9, 10, 11, 12 and particularly 16 of the report of the experimental investigations[10] show how the increase in the richness (heavy hydrocarbon content) of a fluid changes the relation of its phases and alters the value of a fluid property having the characteristics of the critical temperature and pressure. On the basis of these investigations a gas-condensate fluid might have a critical temperature in the range of reservoir temperatures if it consisted of 30 to 50 per cent by weight of hydrocarbons recoverable at the surface as separator liquid. Only a meager amount of information is now available on this subject, but the indications are that a generalizing statement concerning richness of fluid and critical temperatures in the range of reservoir temperatures should stipulate higher weight per cents of the separator liquid than the above figures.

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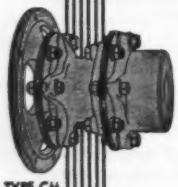

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BOOKS

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EQUIPMENT FOR INCREASING EFFECTIVENESS OF *Pipe-Line Operation*

by Paul Reed

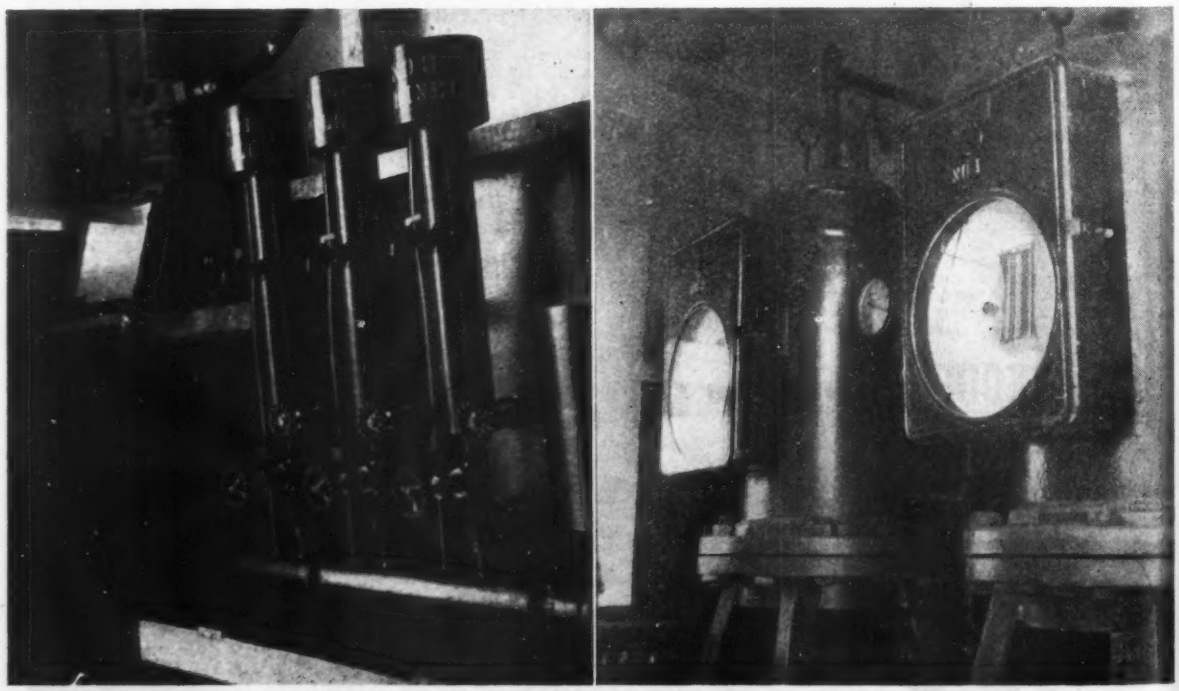
HUMBLE PIPE LINE CO.'S Hearne, Tex., pump station located 21 miles northwest of Bryan is an important point on the company's system where crude-oil lines converge from the east and west to feed into the trunk line to Webster station, midway between Houston and Galveston. Outside the main crude-oil pump station there are pumping facilities for moving natural-gasoline-plant products south from East Texas. At a short distance from the crude-oil station a pump station is being established to serve the new line moving refined products north from Baytown to Dallas.

Several measures are described here which have been devised by the company for increasing the effectiveness of certain aspects of pump station operations.

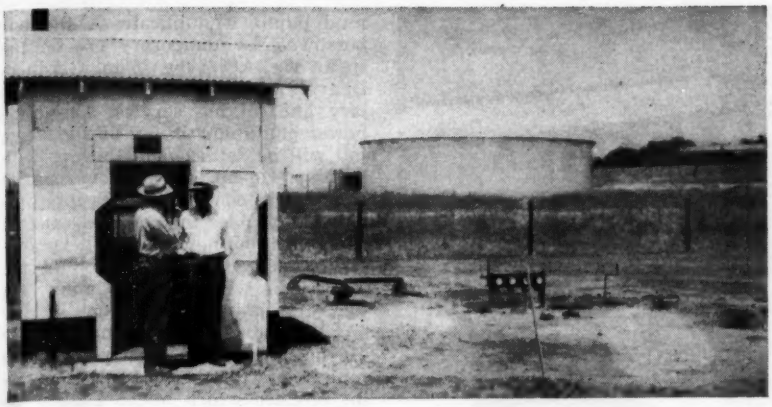
Gages on by-passes to liquid gravity recorders and relief valves on incoming lines

Equipment for Observing Batch Movements

TO observe closely the movement of crude-oil batches, Humble Pipe Line Co. has installed several pieces of equipment in a small house built near incoming lines. This includes three devices for making conventional hydrometer tests, two liquid gravity recorders, range 29.30°-45.4° A.P.I. developed by the Humble Oil & Refining Co., instrument department, Baytown, Tex., and an illuminated glass device. The latter was devised by the chief gager in one of the divisions for identifying two samples



Left: Illuminated glass for color comparison of crude oil and hydrometer test equipment. Right: Liquid gravity recorders



Batch observation house for hydrometer test equipment and gravity recorders

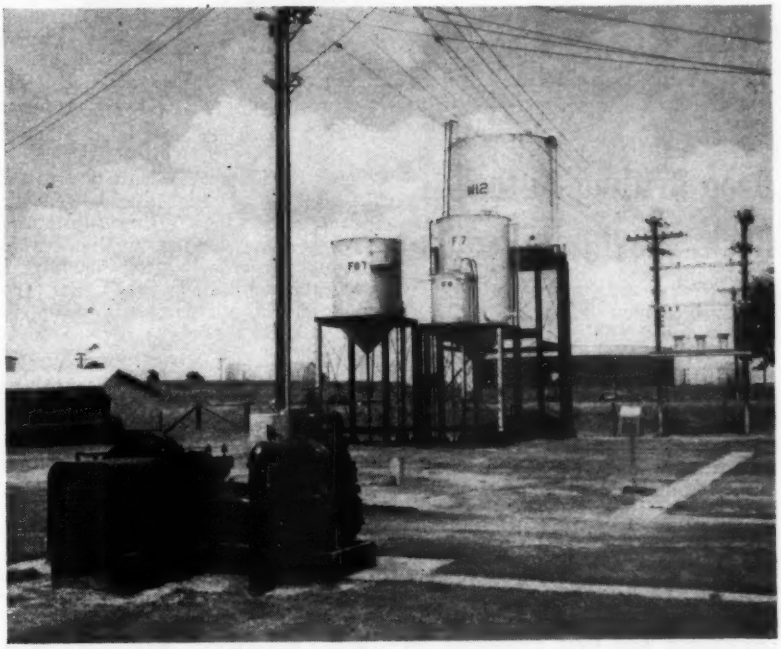
as having distinctly different crude-oil characteristics when the gravities of both would be similar. Such a determination is made by putting a drop from each of two samples on a slanting glass behind which is a 100-watt vaporproof electric-light bulb. Differences in color and viscosity observed in this way indicate differences in the crudes which are sampled.

The liquid gravity recorders give a 24-hour chart record of gravities of crude passing through the station. In the operation of the recorders on a bypassed stream there is a 5-lb. differential pressure across the valve on the bypass streams to the gravity recorders. Pressure gages on the two incoming lines outside the house indicate pressures on both ends of the bypasses. Nearby, a short distance upstream there is a low-pressure relief valve.

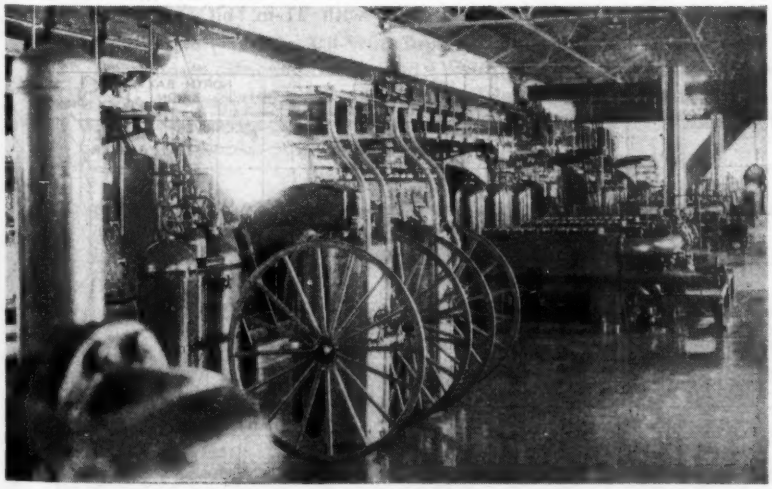
Through the Hearne station the company handles two grades of crude oil from East Texas and seven grades from North and West Texas, making a total of nine grades of crude. Batches are from 50,000 bbl. to 100,000 bbl.

Tanks for Pump-Station Service

IN addition to the large water tank and the two cone-bottomed tanks holding crude oil used for diesel engine fuel, there is a small tank in the group which serves for measuring fuel oil used during a period for testing the performance of an individual diesel engine at Humble Pipe Line Co.'s main line crude oil pump station at the Hearne, Tex., junction point.



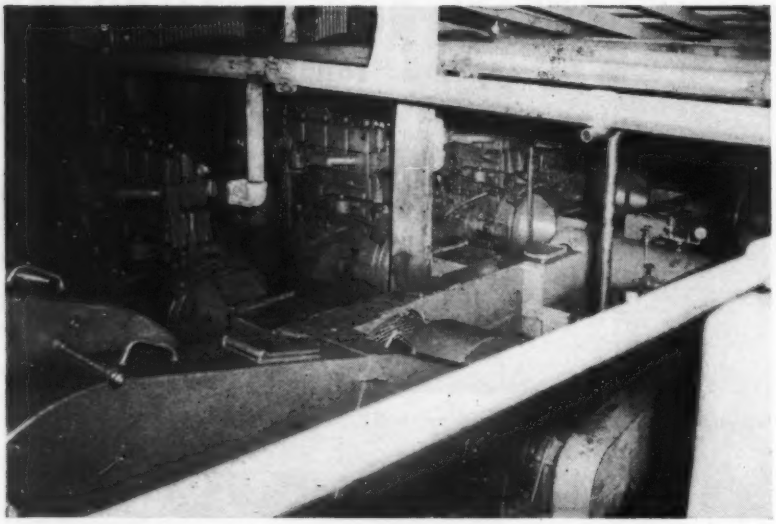
Tank installation including fuel tanks for regular service and for testing



Fire extinguishers located in central position in Hearne pump station

Fire Extinguishers Placed Conveniently

TWO large fire extinguishers are placed in an open space in the engine room of the Hearne pump station. They are readily accessible in an emergency from either inside or outside the station. Since the extinguishers are near large open doors they can be quickly moved outside the station in case this would be desirable for bringing them to a position where they could be advantageously used.



Power plant of direct-drive mechanical rig at Church Buttes. Installation uses four 410-hp. (sea-level rating) gas engines operating through compound drive to draw works and rotary and two mud pumps

Deep Drilling in the Rocky Mountain Region

(Continued from page 62)

which is driven by a 12 by 12-in. twin-cylinder engine. The rotary is independently driven by a 12 by 12 by 5-in. vertical steam engine located at ground level below the derrick floor. With the rig are a 19 by 9¼ by 22-in. mud pump, one of the largest pumps made, and two 15½ by 8½ by 20-in. pumps. Regular mud circulation at this time, however, is being handled by a 7¾ by 18-in. power pump, driven by two 410-hp. gas engines, borrowed from the power rig. The latter pump has been provided as a means of reducing steam requirements, and thus conserving on water use. The rig has ample steam-generating capacity, consisting of four 135-hp. and two 125-hp., 350-psi.-working-pressure boilers, but all water used must be heavily treated. In view of treating costs, use of the power pump is effecting substantial savings. One of the smaller steam pumps is regularly used for mixing and other auxiliary needs, and the other steam pumps are immediately available for reserve or regular use if desired.

Provided with a 178-ft. derrick, this rig is pulling 120-ft. stands of pipe, in this case consisiting of three 40-ft. joints. When 30-ft. joints are made up, it pulls in fourbles. The derrick has a 32-ft. square base, and is set on an 11-ft. substructure. A 57-ft., 6-in. square kelly is being used, and 1¼-in. line is strung in the 300-ton blocks.

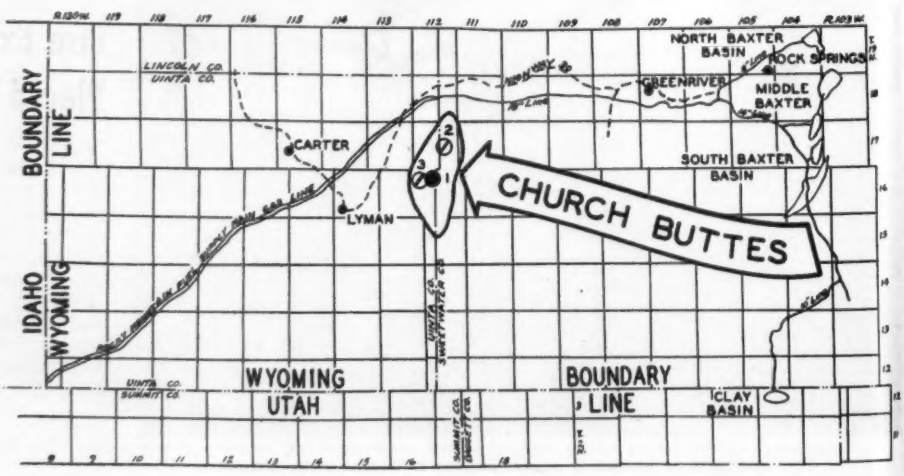
The power rig on Unit No. 3 is a National 125 installation with four Superior G6-10, 410-hp. (sea-level rating) gas engines, which drive both the draw works and rotary and two mud pumps from the engine compound. Regular circulation is handled by a 7¾ by 18-in. Ideal 350 mud pump, a duplicate of the one borrowed for temporary use on the steam rig. A 7¾ by 16-in. Gardner-Denver pump is provided for auxiliary and mixing service. The large power pump now in use on the steam job will be returned to this rig with its two 410-hp. engines as soon as that well is completed since it is proposed to replace the steam rig at that time with another power rig because of the poor water condition in the field. This will give this power rig two large pumps and the one smaller auxiliary and mixing pump. A spare 410-hp. engine has been provided to replace any of the currently operating engines which might have to be shut down for repairs.

On this rig a 155-ft. derrick with 30-ft. square base is being used, and 90-ft. stands of pipe are being pulled as compared with the 120-ft. stands with the steam rig. It is set on a 10-ft. substructure. Extra equipment includes a 150-hp., 350-psi.-working-pressure boiler to supply steam for thawing lines and heat for the crews.

In view of expected high pressures, drilling-control connections on each well include a Schaffer 10,000-psi.-pressure double-gate preventer with one of Hydril's latest 10,000-psi. GK preventers on top.

A somewhat different hole-size and casing program was set up for the present tests from that followed in the first well. It was designed both to give a larger hole and to reduce materially the amount of casing used for the surface and intermediate hole. Called for was approximately 100 ft. of 18⅝-in. upper surface or conductor pipe with up to 3,000 ft. of 13⅜-in. surface casing and eliminating the long intermediate casing string which was run in the first well. Resulting is an unusually long open hole from the bottom of the latter string to the bottom of the hole.

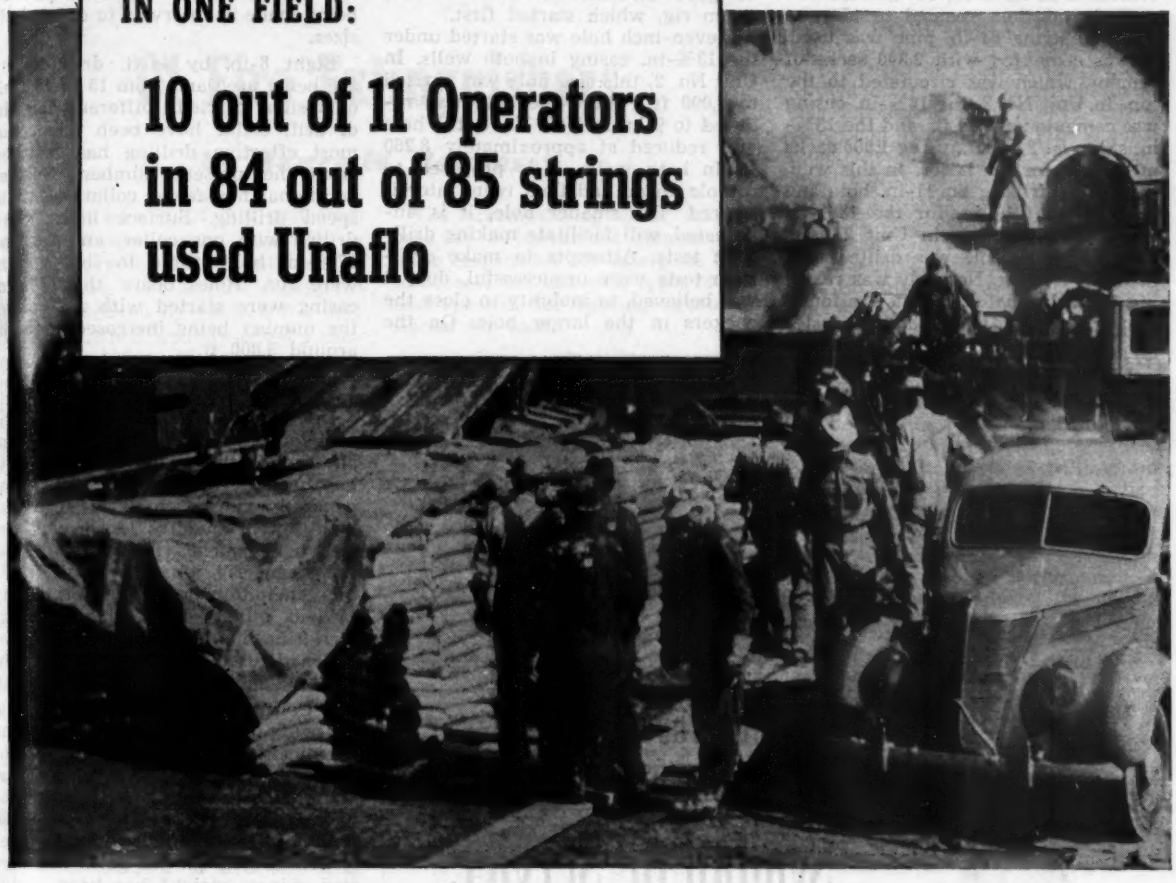
In Unit No. 2, the steam-rig job, the 18⅝-in. casing was set and cemented at 99 ft. Hole for this was drilled with 11-in. bit, and then reamed,



Area map of southwestern Wyoming showing location of Church Buttes structure. Rock Springs, top right, is location of Mountain Fuel Supply Co.'s general offices. Company's main compressor station, taking gas from indicated fields (right) for delivery through 18-in. transmission line to Salt Lake City and Ogden, is located at Green River

IN ONE FIELD:

10 out of 11 Operators in 84 out of 85 strings used Unaflo



- **Temperatures averaged 150°F.**
- **Pressures never much below 3,600 psi.**
- **Strings averaged 8,500 ft. of 5½" casing.**

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Send for "Unaflo Oil-Well Tables," a shirt-pocket booklet of down-the-well volumes of cement and mud. Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Amicable Building, Waco; Kansas City; Birmingham; Chicago; New York. Export Distributors, United States Steel Export Company, New York.

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UNIVERSAL ATLAS CEMENT COMPANY

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first to 17½ in. and then to 24 in. For the 13⅜-in. casing, which was cemented at 2,989 ft., 11-in. hole was drilled and then reamed to 17½ in. For this string 61-lb. pipe was used. It was cemented with 2,300 sacks of cement, which was circulated to the top. In Unit No. 3, the 18⅝-in. casing was cemented at 105 ft., and the 13⅜-in. string at 2,577 ft., using 1,900 sacks of cement for the latter. In this well, instead of drilling an 11-in. hole and reaming to 17½ in. for the 13⅜-in. casing, as was done in Unit 2 well, a full 17½-in. hole was drilled to a depth of 2,584 ft. Not only was reaming time eliminated, but it was found that the 17½-in. hole drilled faster and required fewer bits than the 11-in. hole. This allowed the power rig to gain considerable time on the steam rig, which started first.

Eleven-inch hole was started under the 13⅜-in. casing in both wells. In Unit No. 2, this size hole was carried to 8,099 ft., where the hole was reduced to 9 in. In Unit No. 3, the hole was reduced at approximately 8,260 ft. In both wells, it is proposed to rathole ahead and then ream later if desired. The smaller hole, it is anticipated, will facilitate making drill-stem tests. Attempts to make drill-stem tests were unsuccessful, due, it was believed, to inability to close the packers in the larger hole. On the theory that part of the trouble may be due to washing out and drilling of oversized hole, caliper surveys are being made at intervals to check hole sizes.

Eight 8-in. by 44-ft. drill collars are being used and from 13 to 18 tons of weight carried. Different lengths of drill collar have been tried, but most effective drilling has resulted from the present number. Neither additional nor fewer collars seem to speed drilling. Surface holes were drilled with one collar, and for the 17½-in. holes three to five collars were run. Holes below the 13⅜-in. casing were started with six collars the number being increased to eight around 3,800 ft.

Drilling-Mud Program

Drilling at best has been slow. The best footage which has been made at any time in the lower part of the hole has been 6 ft. per hour. The time generally runs from 3 to 4 ft. per hour and frequently less, sometimes only a few inches. Down to 8,600 ft., the steam rig job had required 131 bits, including one 24-in. bit, thirty 17½-in., ninety-one 11-in., and sixteen 9-in. bits. At 8,260 ft., the power rig had used one 24-in. bit, eight 17½-in. and sixty-seven 11-in. bits.

A California clay-base drilling mud is being used. Some Aquagel and chemicals (caustic and quebracho) are added along to control physical and chemical properties. Down to the Frontier sands a weight of from 80 to 82 lb. per cubic foot (approximately 10.7 to 10.9 lb. per gal.) was carried. Since, weight has been maintained around 90 lb. per cubic foot. (approximately 12 lb. per gal.). Viscosity is being held around 45 seconds and water loss at from 10 to 11 cc.

Sufficient pipe to make up the production casing strings for both of these wells and the two additional proposed tests already has been obtained. Each string, as now designed, will be made up of the following extreme line pipe: 632 ft. of 32-lb. N-80; 3,750 ft. of 26-lb. XL; 1,875 ft. of 26-lb. N-80 L.T.&C.; 3,575 ft. of 29-lb. N-80 L.T.&C.; and 3,168 ft. of 32-lb. N-80 L.T.&C.; total 13,000 ft. It is planned that any correction in total length of setting for well depth will come off the bottom.

Mountain Fuel's 18-in. main gas-transmission line extending from Green River station at Green River, Wyo., about 30 miles east of Church Buttes, to Salt Lake City and Ogden, passes within 6 to 8 miles north of the present wells. Fuel for drilling operations is supplied from this line. This line also will provide an outlet for any marketable gas produced in the field. Water for drilling is piped to the wells from Black Fork Creek, a distance of about 6 miles, where a pumping station is operated by the company.

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UNITED STATES STEEL

Characteristics and Uses Of Fire Extinguishers

by Henry W. Boggess*

(The subject of fire-protection equipment was treated generally in the January 4, 1947, installment of this feature. The author mentioned the two methods by which a fire may be extinguished, and presented a classification of fires. The chart presented on this page lists the characteristics of the various types of fire extinguishers, method of operation, and other factors of interest. The next two installments will discuss the two general types of fire extinguishers in some detail — those which smother the fire, and those which have "cooling" effect.)

*Superintendent of Employment-Insurance-Safety Department, Sinclair Prairie Oil Co.

The accompanying chart may be used as a convenient reference by those responsible for safety, in order to become familiar with types of fires and specific fire-fighting agents designed for each.

	TETRACHLORIDE*	SODA-ACID	FOAM	CARBON DIOXIDE	DRY POWDER
CHEMICALS EMPLOYED—	Carbon tetrachloride with components for depressing freezing point, avoiding corrosion, etc.	Bicarbonate of soda and sulfuric acid	Aluminum sulfate and bicarbonate of soda with foaming agent	Commercially pure liquid carbon dioxide free from moisture	Principally sodium bicarbonate. Moisture repellent and free flowing
METHOD OF OPERATING—	Pump	Invert	Invert	Open valve	Turning hand wheel or pushing lever
PRESSURE METHOD—	Pumping action (on 1-qt. size)	Chemical reaction	Chemical reaction	Pressure stored in cylinder	Pressure stored with cylinder
EFFECTIVE RANGE OF STREAM—	20 ft. or more (under full pump pressure)	30 to 40 ft.	30 to 40 ft.	6 to 8 ft. (Under full pressure)	20 to 25 ft.
LIQUID CAPACITY, (COMMON SIZE)—	¼ Gal.	2½ gal.	2½ gal.	15 lb.	20 to 30 lb.
QUANTITY EXTINGUISHING AGENT PRODUCED—	Quantity variable, depends upon amount of liquid contacting heat of fire	2½ gal.	20 gal.	Quantity variable, about 135 cu. ft. of gas at normal temperatures	Quantity variable, depending upon amount of compound contacting fire
TYPE OF EXTINGUISHING AGENT—	Free gas produced when liquid is vaporized by heat of fire	Liquid, soda solution	Firefoam, a mass of bubbles filled with carbon dioxide gas	Free gas produced when liquid is released from cylinder	CO_2 and water vapor produced when powder comes in contact with fire
EXTINGUISHING AGENT—	Blanketing	Cooling	Blanketing	Blanketing	Blanketing
Class "A" Fires—(Wood) (Textiles) (Rubbish, etc.)	No, other types are better adapted. This type good only under most favorable conditions	Yes, subject to freezing	Yes, subject to freezing	No, does not produce cooling or wetting effect; fire may be extinguished but likely to reignite unless watered	No, does not produce cooling or wetting effect; fire may be extinguished but likely to reignite unless watered
Class "B" Fires—(Oils) (Greases) (etc.)	Yes, but foam type is better adapted. This type good only under most favorable conditions	No; has practically no blanketing effect	Yes; best available because of characteristics not possessed by any other type	Yes, but foam or dry powder types are better adapted. This type handicapped by short range of stream. Difficulty of confining gas at seat of fire except under most favorable conditions	Yes, but foam is considered ideal as it is less affected by wind which may dissipate free gas of dry powder
Class "C" Fires—(Electrical) (Machinery)	Yes, satisfactory where fires have not spread beyond extinguishing capacity of extinguisher and especially in places where current is not likely to be turned off; stream is a non-conductor	No; stream is an electrical conductor	Yes; stream is a conductor but a poor one. Should be used with caution	Yes, best available where fires have not spread beyond extinguishing capacity; has no wetting, no solvent effect and leaves no residue. Should not be used on high voltage account short range and possibility of current grounding through operator	Yes, but CO_2 considered ideal as no residue is left on equipment
Class "D" Fires—(Automobiles) (Commercial) (Trucks, etc.)	Yes, best available because it has a blanketing effect and is not subject to freezing. Small size makes it very adaptable to automobiles	No; practically no blanketing effect, not splash-proof, will freeze. Unsuitable because of size	No; unless splash-proof construction. Will freeze. Unsuitable for pleasure automobile because of size	Yes, has a blanketing effect and will not freeze. Unsuitable for pleasure automobile because of size	Yes, does not freeze; same acceptable qualities as for Class "B"

*Must be used with caution in small rooms; phosgene may be generated.

Abstracts of Seized Patents Are Available From Justice Department

The Office of Alien Property of the United States Department of Justice has announced that it will sell to American citizens for $10, publications containing 4,000 pages summarizing 37,000 mechanical and electrical patents seized from enemy nationals. It is pointed out that these abstracts will be particularly useful as a technical reference for patents and inventions. They are arranged in the 300 classes of the Patent Office classification system thereby facilitating search. Formerly these abstracts were available at $25 a set.

Ten classes are of specific interest to the oil industry, having to do with geometrical instruments, measuring and testing, boring and drilling, ammunition and explosive devices, pumps, cutting and punching sheets and bars, wells, electricity, compositions, handling, hand and hoist-line implements. These abstracts may be purchased separately at 10 and 25 cents.

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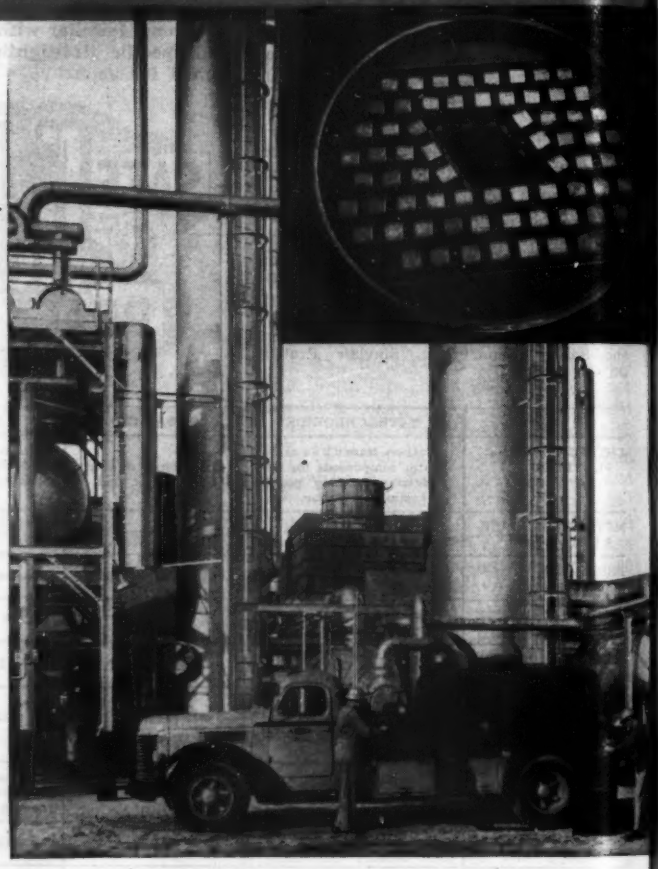

Successful application to bubble towers of Dowell's tested chemical cleaning method helps maintain tower efficiency—helps insure longer operating life for caps, trays, weirs, and for the tower itself. Dowell's rapid chemical cleaning has restored the designed operating efficiency in many, many plants—an achievement familiar to plant engineers who rely upon regular Dowell service to keep boilers, condensers and heat-exchange equipment free of scale and sludge accumulations.

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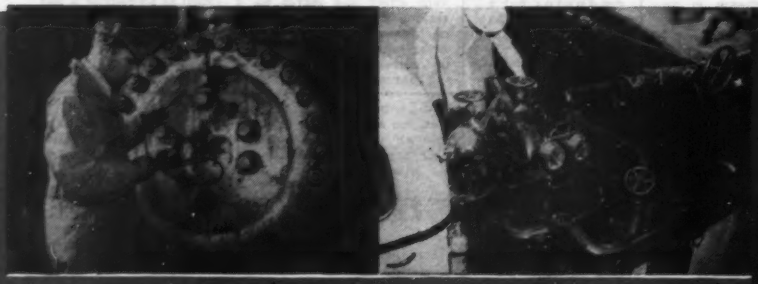


DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

This department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in various phases of plant operation, as well as those connected with the marketing and utilization of petroleum products. Readers are invited to submit their problems to W. L. Nelson, technical editor. Inquiries must be signed, but only the initials will be printed.

Petroleum Wood Preservative

What kind of solvent is used as a wood preservative? Are the solvents from Mid-Continent crude oil satisfactory?—R. C. F.

Petroleum solvents are not used alone as wood preservatives. They are, however, used as solvents for pentachlorophenol which is used fairly extensively as a wood preservative. In the United States in 1944 about 278,000,000 cu. ft. were treated but about 96 per cent of this was treated with creosote. Finally, copper naphthenate and probably some other metallic naphthenates are useful as wood preservatives, and naphthenic acids or the naphthenates are byproducts of the petroleum industry.

The federal Government recommends the use of coal-tar creosote, creosote-coal-tar solutions, or creosote-petroleum solutions for treatment of wood in contact with the ground or water. The straight coal-tar creosote variety is recommended for telephone and power line poles, but the solutions or mixtures may be used for Douglas fir, hemlock, or red cedar.

It is desirable to use at least 50 per cent coal-tar-creosote in any mixture. Creosote petroleum solution has been used for cross ties for many years. More recently creosote - petroleum-pentachlorophenol mixtures have been used for poles. The armed services used solutions of polychlorinated pentachlorophenol in petroleum solvents for tent poles and tent pins. For this service the pressure and non-pressure methods of impregnation were used. Superficial surface treatments were employed for plywood containers, boats, vehicles, and other wood articles. Longest life is attained when the preservative solution is put into the wood by pressure-impregnation methods. Application by brushing is not very satisfactory, particularly with copper naphthenate solutions.

The Western Pine Association suggests the use of pentachlorophenol, tetrachlorophenol, 2-chlororthophenylphenol, or orthophenylphenol in the Permatol type of preservative. These agents may be dissolved in pine oil or petroleum solvents. The toxicity of pentachlorophenol appears to be 10 to 100 times greater than that of coal-tar creosote. Thus, 5 per cent solutions are adequate and as low as 3 per cent has been used. The cost of pentachlorophenol treating solutions is favorable compared with creosote and there is an adequate amount of the chemical available.

Specifications for the petroleum solvents used for chlorophenol preservatives are not rigid. Almost any distillate can be used and even waste crank-case oil has made a good record. Three general types of petroleum solvents are used. They are referred to as (1) penetrants, (2) spreaders, and (3) light fuels. Approximate specifications or recommendations are:

	Penetrants	Spreaders	Light fuel
Flash point	100 min.	110-150	140-160
Gravity	42°-55°	34°-46°	37°-39°
Specific gravity	.763-.812	.802-.837	.820-838
Distillation range, °F.	300-410	310-600	340-690
Color, N.P.A.	1-2	1-3	1-3

The penetrants are thin and hence are able to penetrate deeply and rapidly into the wood, particularly longitudinally along the grain of the wood. They evaporate relatively quickly. The spreaders carry the chemical into the wood at right angles to the grain. They must be less volatile than the penetrants so that they stay in the wood long enough to allow penetration into the wood fiber.

Light fuel oils are cheap and they are able to dissolve the chlorophenols even at low temperatures. Cracked fuel oils are usually not satisfactory because they tend to cause sludging and may dirty the wood. The fuel-oil solvents require a longer time for penetration and evaporation, and may thus lead to difficulties with puttying and painting.

References

1. Western Pine Association—Bull. No. 6 Permatol, Portland, Ore.
2. Blew, Jr., J. O.—Preservatives for Wood, Purchasing, April 1946, p. 97.

Pressure Still Heat Duty

In figuring the B.t.u.'s required to heat an oil in a pressure still, should the latent heat of vaporization be taken into account if the outlet temperature is above the approximate critical temperature of the oil? The rate of feed is 10,400 g.p.h., the temperatures are 344° in and 998° F. out, and the back pressure on the still is 500 psig. Properties of the oil are:

Gravity (degrees)	**30.7**
Mean b.p. (°F.)	**450**
Charac. factor	**11.1**

Any information will be appreciated. —B. E. W.

Under such conditions and in most cracking stills the latent heat of vaporization is nearly negligible. However, the reaction of cracking requires much heat. For each pound of gasoline produced, about 650 B.t.u. are required (Petroleum Refinery Engineering, 2nd Ed., pages 297-298, McGraw-Hill Book Co., Inc., New York). For the above situation:

$$\text{Pounds} = 10{,}400 \times 7.264 = 75{,}500 \text{ lb./hr.}$$

$$\text{Sensible heat} = 75{,}500\,(998 - 344)\,0.8 \times .95 = 37{,}500{,}000 \text{ B.t.u./hr.}$$

$$\text{Heat of cracking, when making 12 wt. \% per pass} = .12 \times 75{,}500 \times 650 = 5{,}900{,}000 \text{ B.t.u./hr.}$$

The useful heat absorption is 43,400,000 (the sum) and if working at an efficiency of 75 per cent, the heat developed in the flame would be 58,000,000 B.t.u. per hour. The extent of cracking that takes place, i.e. the 12 per cent assumed here, varies widely and depends on the time, rate of flow, etc.

More on Graph Paper

Note: J. G. Mitchell comments on our Question on Technology, January 4, 1947, page 67, entitled, "Graph Paper for Vapor Pressure," much as follows:

Graph paper No. 41963 of Keuffel & Esser Co., New York, is suggested for the obtaining of straight-line vapor-pressure curves. This paper has a two-cycle logarithmic scale on one axis and a reciprocal scale on the other axis which is described by:

$$\frac{1}{t + 230}$$

in which t is °C.

In addition, logarithmic-reciprocal graph paper is mentioned on page 253 of Perry's Chemical Engineers' Handbook. Such paper is available from The Educational Exhibition Co., Providence.

Completion Methods

(Continued from page 64)

influence producing capabilities of new wells only slightly at this early stage in the field's history, it is believed by those advocating open-hole completions, that such small increments of added index will loom important in the final years of flowing life since productivity indexes tend to follow the same rate of decline during flush production regardless of their initial values. The relative flowing lives of open hole and perforated wells may shed further light on the merits of the two methods as Fullerton's reservoir pressure declines.

The successful use of formation packers has been an important factor in acceptance of open-hole completion methods at Fullerton. These are widely used in selective acidizing and provide a dependable tool for isolating zones or plugging off gas or water if required in the future.

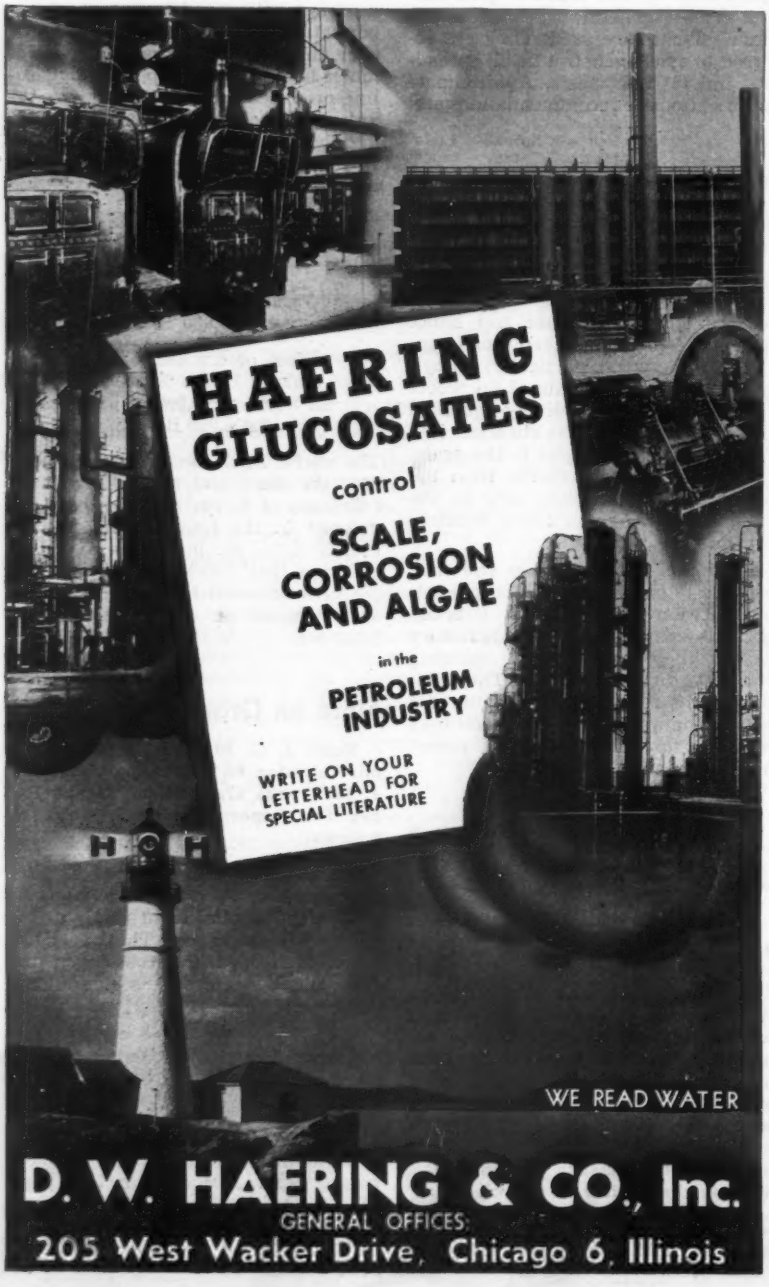
Selective Acidizing

Engineers of Fullerton Oil Co. who have made a detailed study of the three Clear Fork zones under acid treatment, find that breakdown pressures range about as follows: First zone, 2,000-2,700 psi.; second zone as low as 1,400-1,500 psi.; third zone 300-2,900 psi. Where these pressure differences occur, each zone must be treated separately if acid treatment is to be equal throughout the Clear Fork section.

Two practices are used in drilling the pay zones and selectively acidizing them. Most operators set production casing at or above the top of the first zone, then drill completely through the pay sections to total depth. Fig. 1 outlines the steps followed. A formation packer with a side-door choke is set between the middle and lower zones and each is treated in three stages, using about 6,000 gal. After the two lower zones are cleaned, the packer is pulled and reset between the top and middle zones and the top zone is given 6,000 gal., usually in two stages. This method requires relatively little time, averaging two days.

The practice of drilling and acidizing each zone separately was followed largely in early wells and has been continued by one major producer. As illustrated schematically in Fig. 2, after setting casing at the top of the first zone, drilling fluid is displaced with oil and the first zone is drilled. With a packer set inside the casing, that zone is acidized in one stage with 6,000 gal. After cleaning the pay, the second zone is drilled, a formation packer set between it and the top zone and it is treated with 8,000 gal., also in one stage. The same procedure is followed in the third zone which is given 6,000 gal. A variation of this method calls for drilling the first two zones together and acidizing separately using a side-door choke, after which the third zone is drilled and treated as above. After each zone has been cleaned to less than 3 per cent acid, a hook-wall packer is set at the bottom of the casing and all drilling fluid in the annulus between casing and tubing is displaced by sweet oil to retard corrosion. This completion procedure takes about 5 to 6 days. Engineers consider the extra time and care worth while since it prevents the possibility of forcing mud into the formation and allows truly selective acidizing of the three zones. After converting to oil for drilling, pits are removed a safe distance from the rig to lessen fire hazard Discounting time and expense, this is considered the best method for completing in the Clear Fork.

A third open-hole completion method followed in the Clear Fork formation involves acidizing all three zones simultaneously under high pressure. Its principal advantage is quick reversal. After production casing is set, the hole is drilled through all producing zones. The well is swabbed in and then loaded with oil. An average of 12,000 gal. of acid is then pumped rapidly down the casing in one stage at pressures of 2,000-2,220



psi. In some wells this is varied by releasing the rig on reaching total depth, swabbing in, and allowing the well to stand for 2 or 3 days for a pressure buildup. A total of 7,000 gal. of acid is then pumped down the casing and as soon as it is displaced with oil in the hole, the tubing is opened and the well allowed to flow, unloading naturally. In such cases wells cleaned in about 6 to 8 hours. Disadvantage in this method is uncertainty of where acid went, since all zones were exposed to the same treatment.

Ellenburger Completions

Fullerton Oil has continued its practice of protecting the formation as much as possible in its three recently completed Ellenburger producers. The hole size is reduced at the top of the pay, the entire pay section is drilled to total depth and a cement plug of about 50 sacks is dumped on bottom and allowed to set up without pressure (Fig. 3). The plug extends well above the top of the porous lime pay. After the plug has set, it is drilled to a point desired for the casing seat, just above the pay, and 5½-in. casing is set in the usual manner. The cement plug on bottom is then drilled to total depth and the section opposite the pay is reamed to remove all remaining cement.

Multistage Centrifugal Compressor Applications

(Continued from page 69)

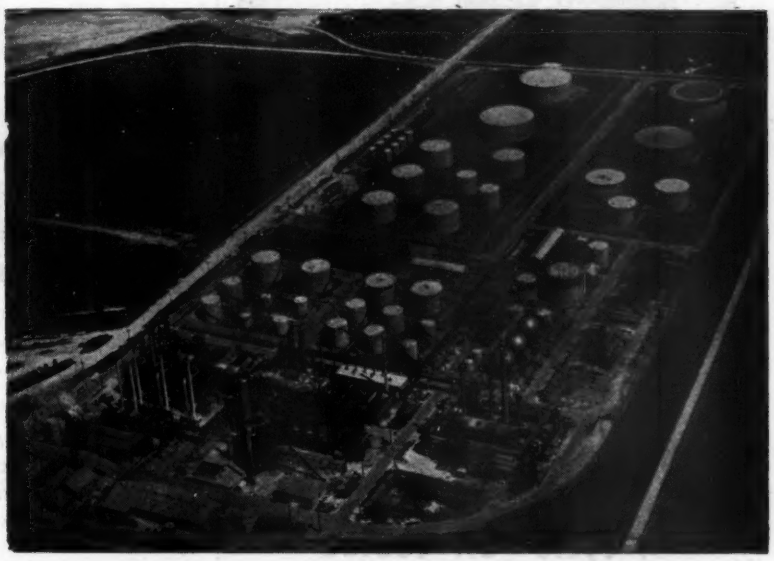
factors employed for the gases that deviate excessively from air. It has been felt that the use of such factors will prove more cumbersome, in the future, than solving for the polytropic exponent.

When working with the actual head, one set of rating curves will suffice if the application engineer will avoid exceeding sonic speed with the gas to be compressed. The critical condition exists at the impeller inlet and results in the phenomenon sometimes referred to as the stone wall. As the speed and head are increased, the surge point moves over toward the stone wall thereby decreasing the stable range of operation. With air and low-molecular-weight gases we do not normally encounter this sonic speed phenomenon.

It is apparent that machines with relatively flat head characteristics are sensitive to head variations. It is for this reason that the centrifugal application engineer thinks in terms of head and carefully selects the rotative speed that will produce the required head. The reciprocating application engineer, on the other hand, gives due consideration to volumetric efficiency which is relatively unimportant in centrifugal selections. The reciprocating machine may be said to have a relatively flat volume characteristic at a given speed as its head varies over a wide range with slight changes in volume. The reciprocating compressor is sensitive to volume and is often furnished with clearance pockets or speed variation. The centrifugal is sensitive to speed and is more often furnished with variable speed and suction dampening than with bypass.

It is important that a centrifugal machine and its driver be selected for a speed that will permit the compressor to deliver the required pressure differential with the minimum gravity gas the machine will be called upon to handle. If this precaution is taken there need be no fear of the machines coping with variable head or pressure conditions. Fluctuations in load are accompanied by rapid changes in head to which the machine responds almost instantaneously through the medium of a relatively simple control device.

Generally speaking, the economics of the driver, in the petroleum industry, is considered to be of greater significance than the compressor. Therefore, when burning of fuel gas direct offers the most economical power, it would appear that the centrifugal compressor will continue in a disadvantageous competitive position for some time to come.



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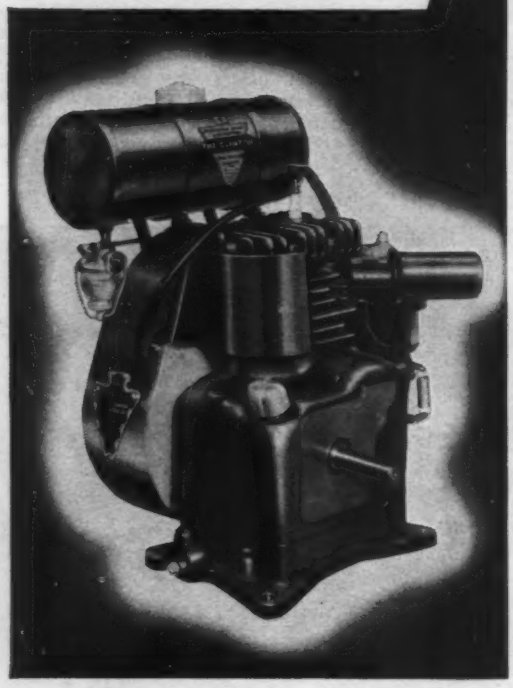

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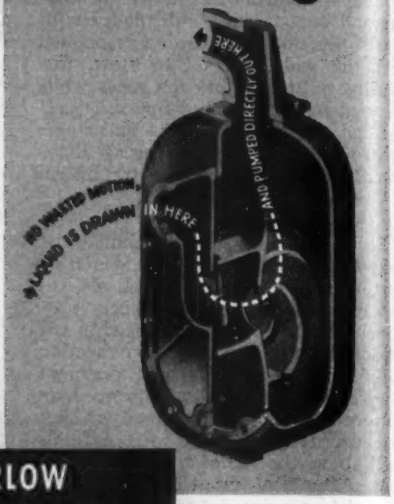

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- **Self-compensating dripless seal eliminates costly shut-downs for repacking.**
- **No ports to clog or jam.**
- **Nothing to adjust or manipulate; easy to operate.**
- **Durability assured by strong, long-life construction.**

DEPENDABLE

A Marlow will operate in intermittent service and purge itself whenever necessary. Sound engineering and rugged construction enable a Marlow to perform reliably and economically in long hard service.

Electric, gasoline or Diesel powered, 1½ to 10-inch sizes, capacities 70 to 5,700 barrels per hour. Detailed information will be sent promptly.

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MANUFACTURERS OF QUALITY PUMPS SINCE 1924.

MODERN Rotary DRILLING

"In Line" Layout for Steam Rig

ANOTHER standard location layout for a modern steam rig is shown in Fig. 3.[1]

The layout shows again the "in-line" arrangement of engine, pumps and boilers, illustrated in the preceding installment. It has in addition certain other features which represent even more radical departure from the long-accepted norms of setting up a rig.

The V-side of the derrick is facing the boilers. This fact together with proper arrangement of pits and pumps in relation to the roadway results in a very considerable saving in the space needed for the location as a whole. This is an important advantage in case of all difficult locations and in case of locations in cultivated areas where space is at a premium.

The boilers are set with their firebox ends lined up on the center line of the well. In moving, the pumps are skidded first in their place on the pump platform, which accommodates also the mixer and the storage house for mud materials. With the latter being placed closest to the roadway, handling of these materials in unloading from the trucks is reduced to a minimum.

Reference

1. Rowan Drilling Co., Fort Worth.

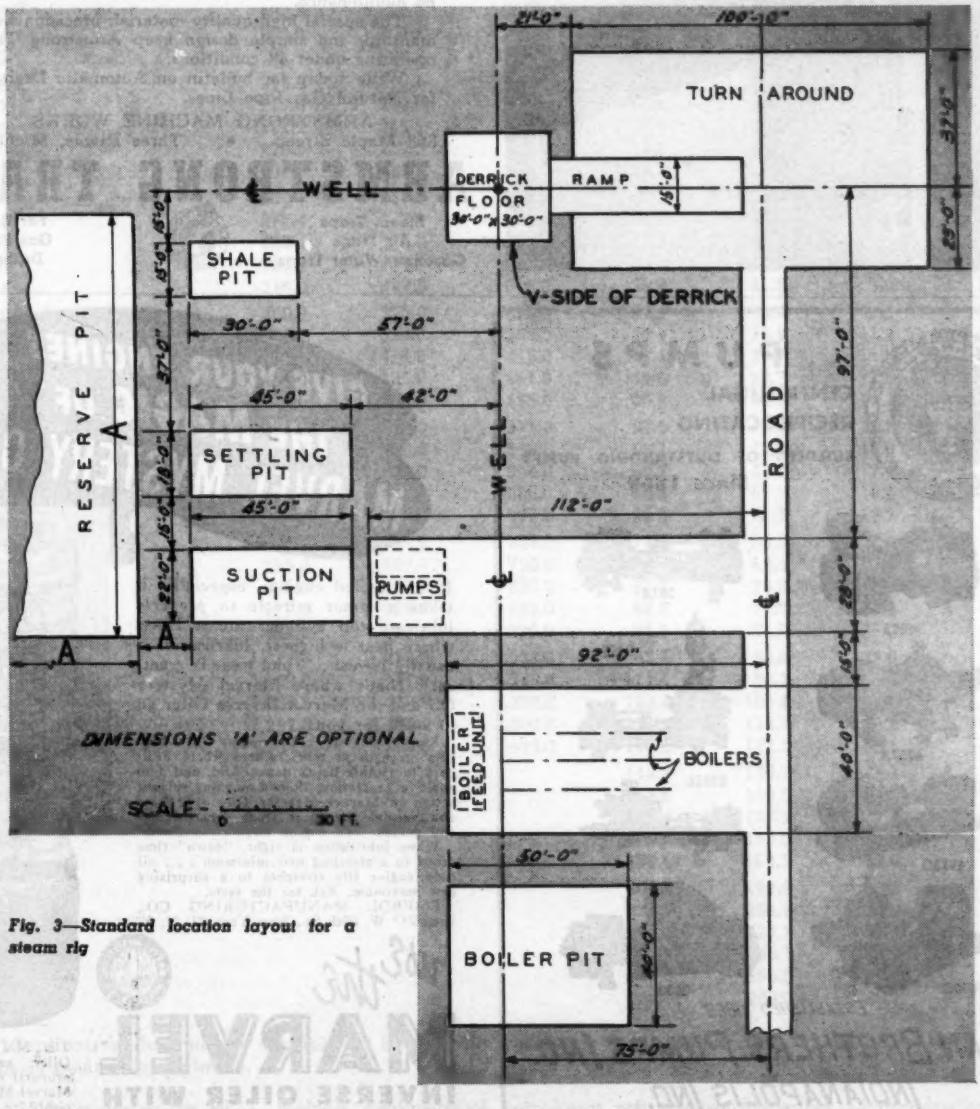

Fig. 3—Standard location layout for a steam rig

No. 6 in a series by Joseph Zaba, petroleum engineer, Houston

the *Positive, Automatic* Way to Drain Gas Line Drip Pockets

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ARMSTRONG Inverted Bucket Traps remove all water automatically from drip pocket and separators along pipe lines as fast as it is formed. There is no chance for it to collect and reduce cross-sectional area of the pipe thereby cutting efficiency of the line and requiring more power to move the same amount of gas. The traps eliminate the human element and save labor for other jobs.

On gas service where pressure and temperature conditions are high, Armstrong Traps with parts designed for pressures as high as 1500 lbs. and temperatures of 750° give a lifetime of service with little or no maintenance.

The special high quality material, precision workmanship, and simple design keep Armstrong Traps operating under all conditions.

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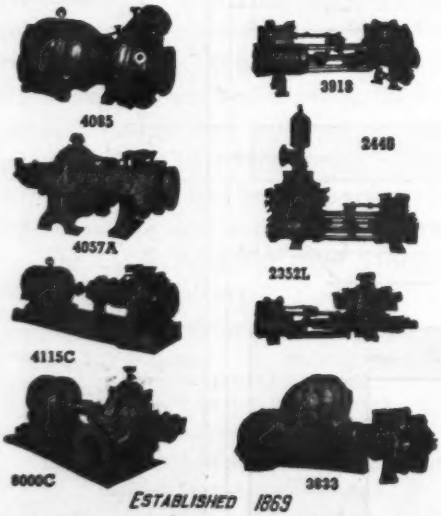

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Marvel Mystery Oil retains *extra*-high film strength at temperatures where ordinary lubricants break down. And, added to positive protection, there's amazing solvent action in Marvel Mystery Oil . . . gums and varnish disappear from valves, rings and guides. The engine *stays clean* inside.

When lubrication is right, "down" time drops to a startling new minimum . . . oil field engine life stretches to a surprising new maximum. Ask for the facts.

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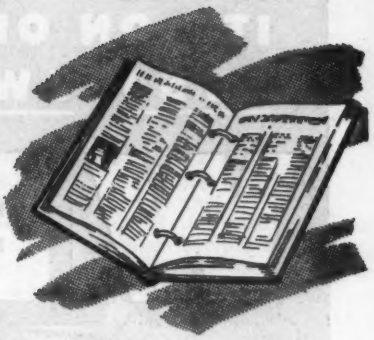
The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Viscosity by Different Instruments—High Range

Kinematic,* Centistokes	Saybolt Universal,† at these temperatures			Saybolt Furol	Redwood Admiralty No. 2	Engler Degrees	Redwood Standard No. 1
	100° F.	130° F.	210° F.				
41	190.2	190.6	191.5	(21.8)	...	5.49	168.3
42	194.7	195.1	196.1	(22.2)	...	5.62	172.3
43	199.2	199.6	200.6	(22.5)	(18.8)	5.75	176.4
44	203.8	204.2	205.2	(23.0)	...	5.88	180.4
45	208.4	208.8	209.9	(23.4)	...	6.00	184.5
46	213.0	213.4	214.5	(23.9)	(20.0)	6.08	188.5
47	217.6	218.0	219.1	(24.4)	(20,3)	6.19	192.5
48	222.2	222.6	223.8	24.8	(20.7)	6.32	196.6
49	226.8	227.2	228.4	25.2	(21.1)	6.45	200.7
50	231.4	231.8	233.0	25.5	(21.4)	6.58	204.7
55	254.4	254.9	256.2	27.5	(23.4)	7.24	225.0
60	277.4	277.9	279.3	29.6	(25.6)	7.89	245.3
65	300.4	301.0	302.5	31.6	(27.8)	8.56	265.5
70	323.4	324.0	325.7	33.7	(30.0)	9.21	286.0
75	346.0	347.0	349.0	35.8	31.8	9.88	306.0
80	369.0	370.0	372.0	37.9	33.8	10.5	327.0
85	392.0	393.0	395.0	40.1	35.8	11.2	347.0
90	415.0	416.0	418.0	42.4	37.7	11.8	367.0
95	438.0	439.0	441.0	44.6	39.7	12.5	387.0
100	462.0	463.0	465.0	46.9	41.7	13.2	408.0
110	508.0	509.0	511.0	51.5	45.7	14.5	449.0
120	554.0	556.0	558.0	56.1	49.6	15.8	490.0
130	600.0	602.0	604.0	60.7	53.7	17.1	531.0
140	646.0	648.0	650.0	65.3	57.7	18.4	571.0
150	693.0	695.0	697.0	69.8	61.7	19.7	612.0
160	739.0	741.0	744.0	74.5	65.7	21.0	653.0
170	785.0	787.0	790.0	79.1	69.8	22.4	694.0
180	831.0	833.0	836.0	83.7	73.8	23.7	735.0
190	877.0	879.0	883.0	88.3	77.9	25.0	776.0
200	924.0	926.0	930.0	92.9	81.9	26.3	816.0
220	1,017.0	1,019.0	1,023.0	102.1	90.0	29.0	898.0
240	1,108.0	1,111.0	1,115.0	111.4	98.1	31.6	980.0
260	1,200.0	1,203.0	1,208.0	120.6	106.2	34.2	1,062.0
280	1,292.0	1,295.0	1,300.0	129.9	114.4	36.8	.....
300	1,384.0	1,388.0	1,393.0	139.1	122.5	39.5	.....
320	.....	.....	.....	148.4	130.7	42.1	.....
340	.....	.....	.....	157.6	138.9	44.7	.....
360	.....	.....	.....	166.9	147.1	47.4	.....
380	.....	.....	.....	176.1	155.3	50.0	.....
400	.....	.....	.....	185.4	163.5	52.6	.....
450	.....	.....	.....	208.5	183.9	59.2	.....
500	.....	.....	.....	231.6	204.3	65.8	.....
550	.....	.....	.....	254.8	224.7	72.4	.....
600	.....	.....	.....	278.0	245.1	79.0	.....
650	.....	.....	.....	301.0	265.6	85.0	.....
700	.....	.....	.....	324.0	286.0	92.1	.....

*Centipoises obtained by multiplying by specific gravity at same temperature. †A.S.T.M., D-446. () Parenthesis means approximate.

No. 130 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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JUST TWO TURNS!

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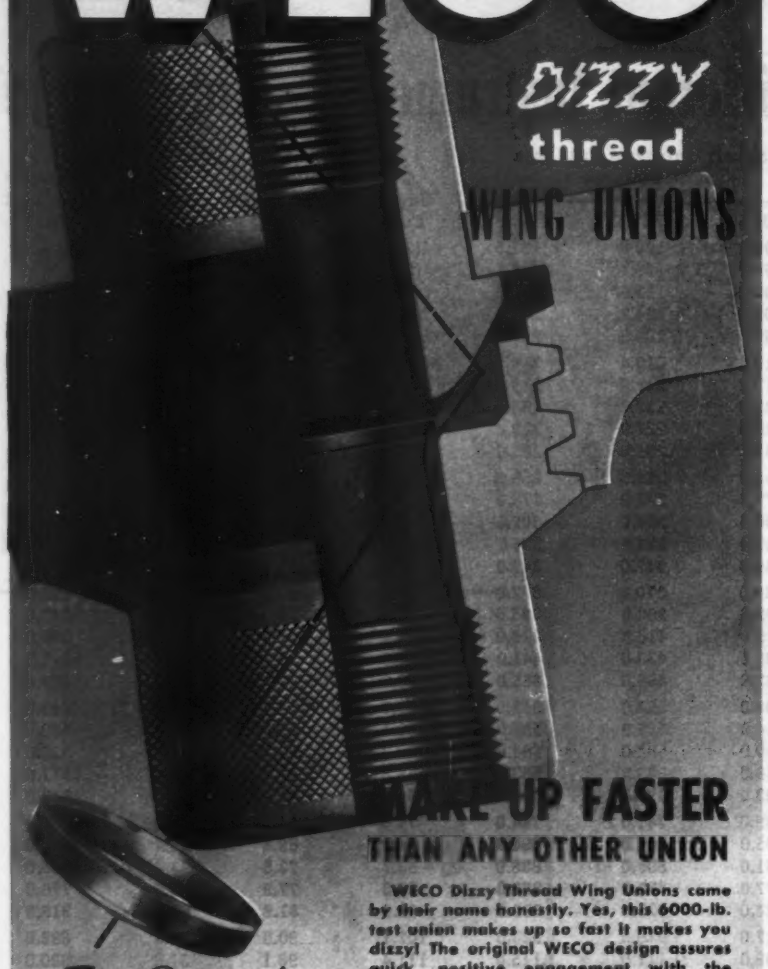

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WECO Dizzy Thread Wing Unions came by their name honestly. Yes, this 6000-lb. test union makes up so fast it makes you dizzy! The original WECO design assures quick, positive engagement with the threads. The spherical male permits faster, perfect stabbing. It means maximum speed and safety with minimum effort on every hook-up. You can't buy a better union for your high pressure lines. Made in 1" size for Blowout Preventer hook-ups. Dizzy Thread Unions are one leading member of the most complete line of wing unions in the world. Yes, buy the best . . . buy WECO. Stocked by leading supply stores. Write for our latest catalog.

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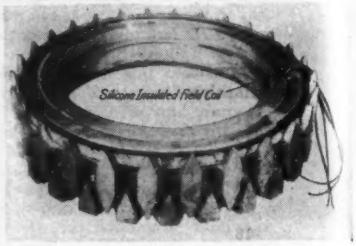
Silicone News

DC

DC Silicone Insulation Extends Life of Electro-magnetic Brake



PHOTO, COURTESY DYNAMATIC CORPORATION, SUBSIDIARY OF EATON MANUFACTURING COMPANY

Protects water cooled field coil in this magnetic field member.

In producing electro-magnetic brakes for well drilling rigs, the Dynamatic Corporation, of Kenosha, Wisconsin, tested and adopted DC Silicone Insulation. Moisture infiltration limited the life of coils treated with organic varnishes. Protected by DC 996, none of these coils has failed.

These brakes exert a variable and controllable retarding effect without friction or wearing parts. Fundamentally, they involve the rotation of an iron drum through a variable magnetic field created by stationary coils inside the drum. Eddy currents generated in the rotating drum exert on the rotor a torque which varies with the amount of current admitted to the field coils.

A heavy duty model absorbs up to 5,000 horsepower, providing speeds from 800 r.p.m. down to a rate that permits the setting of slips on the heaviest strings of drill pipe.

The permanently sealed field coils are cooled by water circulating over the field casting and eddy current members. But DC 996 excludes moisture indefinitely even at high operating temperatures. Insulation resistance remains high despite long exposure to weather when a rig is idle. And, when drilling is resumed, this resistance rises rapidly and soon reaches infinity.

DC 996 is described in leaflet No. Y 3-4.

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ENGINEERING fundamentals

Slime and Algae Control

SLIME and algae micro-organisms, despite their diminutive size, are capable of multiplying rapidly and thus producing large masses of plant material, the prevention and elimination of which frequently constitute a major engineering problem. The problems of slime and algae control are closely related in that both result from the growth of micro-organisms in aqueous media and in each case the use of certain toxic chemicals has proven effective in their control.

Algae

Algae are among the lowest and simplest forms of plant life, so small that they can be studied only with the aid of a microscope. The various species may occur as single cells or be united by a gelatinous substance into chains, filaments, and more often, large masses. Algae growths may contain variant amounts of simple animal life, depending upon whether the deposit is completely or partly submerged.

Algae control is especially important in the maintenance of high operating efficiencies in modern heat-transfer systems and apparatus. Algae growths seriously impair the rapid circulation of the conducting fluids and easily become attached to heat-transfer surfaces to form slimy deposits of high insulating value.

Slime

A slime deposit differs from a purely algal growth in that it is denser, more gelatinous and usually more tightly adherent to the surface affected. Slime deposits may sometimes be the result of algae accumulations only, but they are usually comparatively rich in simple animal life. Slime may also contain inorganic and organic debris mechanically entrapped together with scale forming salts such as calcium carbonate. The reuse of cooling water in circulating systems must be accompanied by intelligent chemical treatment, as such systems favor slime and algae formation as well as mineral incrustation by scale-forming solids present in water.

Treatment

Mechanical elimination of slime and algae deposits, consisting merely of periodical manual cleaning, is the simplest in principle but most complicated and usually least satisfactory in practice.

Physical methods have had only limited success in the elimination or prevention of slime and algae deposits. Electric currents can be applied to prevent attachment of these deposits or ultra-violet rays used to kill the organisms. Since algae will not grow in the dark, covering of reservoirs has in some cases proved quite effective.

Only by chemical means can slime and algae growth be continuously controlled effectively and economically. Costs cannot be compared on a pound-for-pound basis, as frequently the cheapest material proves to be the most expensive per unit of weight; hence, cost of treatment must be based on unit of performance.

Caustic alkali and acid solution have been occasionally resorted to for rapid removal of deposits by dissolving the inorganic salts which strengthen the attachment or by disintegrating the deposits themselves. Such treatment, however, is difficult, dangerous, and costly, subsequently applicable only to relatively small systems and as an emergency measure.

Copper salts.—Copper sulfate is one of the oldest and most widely used of algaecides. The dosage required to kill algae may vary from 0.05 to 10 p.p.m. so that an accurate knowledge of the particular species of organism present is essential if the treatment is to be successful. Copper salts are rather toxic to fish, which may be a serious disadvantage in some cases.

Chlorine.—Since chlorine is toxic to bacteria and algae alike, it serves a dual purpose in the sterilization of drinking water supplies. Chlorine possesses a remarkably high toxicity, requiring only 0.5 p.p.m. residual to destroy most micro-organisms. It is stable in neutral, acid, and alkaline waters, although its toxic efficiency is reduced somewhat by highly alkaline conditions. While chlorine is destructive to most metals when used in concentrated form, it has no corrosive effect in the low concentrations required for bacteria and algae control.

Chloramines.—Efforts to suppress the oxidizing action of chlorine and utilize only its toxinogenic powers have resulted in the development of the chloramination process. This consists essentially in feeding both chlorine and ammonia in the correct proportions to form chloramines. The chloramines are unstable in concentrated form, but very reactive and quite toxic to .micro-organisms in the small concentrations employed for water treatment. Not being powerful oxidizing agents, practically all of their toxic power is available for the destruction of micro-organisms.

For this reason, 1 p.p.m. of chloramine may be as effective as several p.p.m. of chlorine.

Sodium pentachlorphenate.—Of the many synthetic organic algaecides, sodium pentachlorphenate (C_6Cl_5ONa) has proved particularly effective for the control of slime and algae formation in industrial cooling water systems. In addition to a high degree of toxicity, this chemical possesses physical and chemical properties which render it especially suitable for the treatment of circulating water. Being the sodium salt of a chlorinated phenol, it is stable in alkaline water and can be used under conditions of high pH that would render copper salts useless and reduce the effectiveness of chlorine. Sodium pentachlorphenate, however, because of its toxicity to man, cannot be utilized for domestic water supplies.

This material is from the Betz Handbook for Industrial Water Conditioning, written and published by W. H. and L. D. Betz, consulting engineers, Philadelphia.

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You are not gambling when you use the EXCEL-SO Separator/Filter in the de-watering and cleaning of petroleum products streams. This Separator/Filter, the ORIGINAL and only EXCEL-SO, eliminates water, debris and other foreign matter with an efficiency of 99.999 per cent.

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REFINING

Texaco Picks Site For New Refinery

NEW YORK.—The first unit of The Texas Co.'s Philadelphia-Camden area refinery will have a daily capacity of 40,000 bbl., according to G. R. Bryant, general manager of Texaco's refining department. No date was given as when it is expected to complete this refinery which will be located at Eagle Point in West Deptford Township, Gloucester County, N. J. The refinery will be more than 5 miles downstream from the Philadelphia-Camden bridge.

Dwindling domestic crude-oil reserves, expanding demand for petroleum products, and the possibility that crude oil may soon be imported into the United States in substantial quantities influenced Texaco to locate its new East Coast refinery in the Philadelphia-Camden area.

Other factors influencing the choice of Eagle Point, Bryant explained, were the availability of a deep-water terminal, ample coastwise and interior transportation facilities, and the fact that "the Philadelphia-Camden area is an excellent community in which to do business."

Completion of the refinery, a key project in the company's postwar expansion program, will depend largely upon the availability of materials.

California Standard Opens New Oregon Asphalt Plant

Initial production of asphalt has been started by California Asphalt Corp., a subsidiary of Standard Oil Co. of California, at a new refinery at Willbridge, Ore.

The plant is expected to produce between 4,000 and 5,000 bbl. of asphalt daily when it gets in full production. Contracts for construction were let late in 1945 and it was hoped to begin production last summer, but slowness of materials deliveries delayed plans.

Crude stock will be shipped from California by tanker direct to new Oregon plant. Willbridge is some 700 miles north of California Standard's Richmond refinery which formerly supplied asphalt for markets in the Pacific Northwest.

Another new Oregon asphalt plant, that of Shell Oil Co., Inc., at Portland, went on stream last fall. The Shell plant cost approximately $300,000 and receives charging stock from Martinez by tanker.

Celanese Bishop Plant Adds to Product List

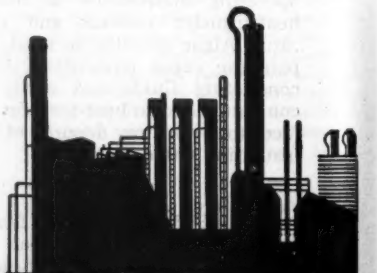
Celanese Corp. began commercial manufacture of propanol (normal propyl alcohol) and of propionaldehyde recently at its plant near Bishop, Tex.

These products extend the list of organic chemical derivatives of natural gas made by this company. Acetic acid and acetaldehyde were put into large-scale production about a year ago, and later acetone, methanol (methyl or "wood" alcohol), and formaldehyde were added to the list of products. Formaldehyde, propionaldehyde, and acetaldehyde are intermediate for plastics and resins as well as for other syntheses. The alcohols and ketones are used mainly as solvents at present.

Tide Water to Install Desalter at Avon, Calif.

Tide Water Associated Oil Co. will install a high-capacity Petreco electric-desalting unit in conjunction with a new crude-distillation unit at their Avon, Calif., refinery.

The proposed desalter is of latest development, fully automatic, and is designed to handle 25,000 bbl. per



We design and construct all types of modern refining units.

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BORN ENGINEERING CO.
Tulsa, Oklahoma

day of Ventura crude. This is the first high-capacity Petreco desalter to be installed in the San Francisco Bay area, according to an announcement. Capacity of Tide Water's Avon refinery is 60,900 bbl. daily crude and 51,400 bbl. daily cracking.

New Catalyst Announced By American Cyanamid

NEW YORK.—Aerocat, Grade MS-A is the name of the newest fluid catalyst for oil-cracking operations announced in New York by American Cyanamid Corp., in collaboration with various oil companies.

The new catalyst is microspherical in form, which resists attrition and production of "fines" more successfully. Extreme care is said to be exercised to control spheroid size carefully, making for more catalyst efficiency. Additions to the company's Fort Worth catalyst plant enables that plant to manufacture the catalyst in commercial quantities, it is announced.

Esso Lab Develops New Synthetic Resin

A new-type synthetic resin from petroleum which can be applied successfully to iron, brass, bronze, aluminum and highly polished metal, in addition to wood and steel, has been developed by Esso Laboratories, it is reported in the current issue of The Lamp, publication of the Standard Oil Co. (New Jersey).

Called A-resin, the substance was tailored to the specifications of the paint and varnish industry and at the time the work was statred—3 years ago—no satisfactory process had been developed to make high-quality synthetic resins from crude oil. Technicians of the paint and varnish industry cooperated very closely with the Esso Laboratories in the development.

An A-resin coating is said to have excellent qualities of adhesion, flexibility and wetting power which particularly fit it for use on surfaces difficult to paint with ordinary paint. As a baked priming coat on automobiles it is hard, durable, light-fast and chemically resistant. An A-resin can-coating that is only 0.0002 in. thick remains unbroken even when the metal sheets are stamped and punched. It withstands the pasteurization treatment of 20 minutes under 15 lb. of steam pressure at 250° F. and is unaffected by the extremely high acidity of grapefruit and certain other canned fruit and vegetable juices. A-resin pigmented films air-dry quickly, have good light stability and retain a high and lasting gloss.

Alberta Refinery to Go On Stream About April 1

EDMONTON, Alta. — Announcement has been made that Husky Refining Co. will begin processing crude at Lloydminster, Alta., on or before April 1.

Initial capacity of the refinery will be 2,500 bbl. daily which can be stepped up to 7,500 bbl. if necessary. Arthur C. Knight is Canadian manager for the company, which also will drill in the Lloydminster field.

German Synthetic Plant Unloaded at New Orleans

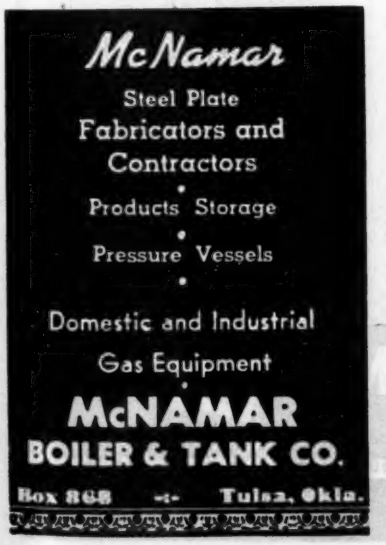
Parts of a German synthetic oil plant formerly located at Bremen are reported now being unloaded at the port of New Orleans for shipment to Louisiana, Mo., where the Government is conducting synthetic-oil experiments.

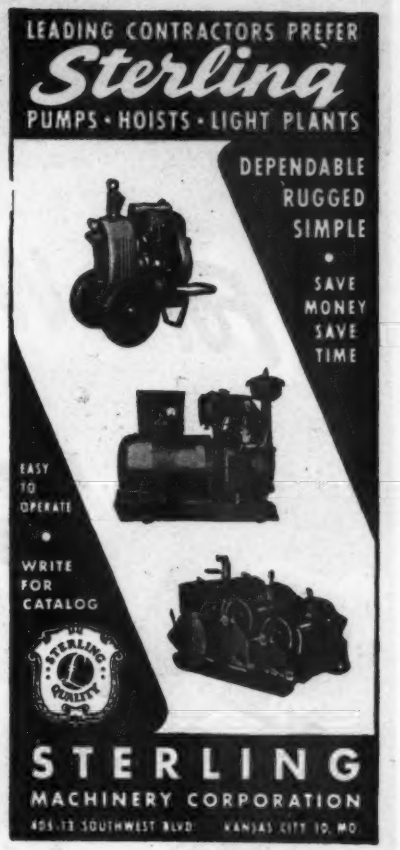
Equipment arriving at New Orleans included a steel vessel weighing 132 tons and approximately 100 ft. high.

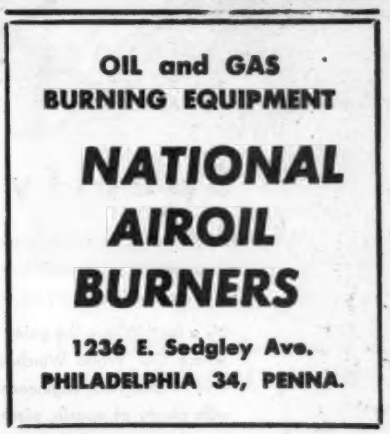
Mid-Continent Bright-Stock Production Registers Drop

Bright-stock production of 12 Mid-Continent refineries totaled 236,647 bbl. during December, a drop of 3,164 bbl. from November's production of 239,811 bbl.

Figures released by the Western Petroleum Refiners Association shows a gain of 24,018 bbl. in the production of viscous neutrals with a total output of 376,188 bbl., against 352,170 bbl. in November. Inventories of bright stocks totaled 185,711 bbl. December, a gain of 20,911 bbl. over the November 30 inventory, and inventories of viscous neutrals totaled 259,654 bbl., a gain of 29,576 bbl. over November 30.







Specify Gar Wood!

Maybe it isn't a pretty *word*... but it's a *mighty* beautiful sight to watch those good Gar Wood Winches hauling and lifting and skidding 40-ton loads around as easily as only they can.

It's a fact! Where the going is roughest, where the job is toughest... *that's* where Gar Wood Winches *really* prove themselves... every time! For they're designed, engineered, and built for *dependable*, extra power... with plenty of muscle, plenty of *guts*... literally *built to take a beating!*

If an "impossible", extra-tough job has *you* down, take a look at the new Gar Wood 7MBD (illustrated)... the biggest, toughest truck winch in the world. 4¼" drumshaft, 75,000 lb. rope pull... handles almost any load ... easily, safely, and *fast*. Full cab control of jaw clutch and brake, brake band on drum flange, automatic safety brake on worm shaft. And power ... *guts* to spare! .... *For your own good... specify Gar Wood!*

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PIPE LINES

Colorado Interstate Lets Contracts

Colorado Interstate Gas Co. has let contracts for the main line and gathering system for transmission of natural gas from Hugoton field to Denver, subject to approval of the project by the Federal Power Commission and the Public Service Commission of Colorado.

The main line consists of 260 miles of 20-in. with ¼-in. wall thickness from Lakin, Kans., (west of Garden City, Kans.) to the outskirts of Denver. The contract for the laying of this line was awarded to J. R. Horrigan Construction Co. Construction will start at Lakin with one spread early in May. Later a second spread will be moved to the job. The line is to be coated with coal-tar enamel and wrapped with asbestos felt. From the control point, at which the 20-in. main line will terminate east of the Denver city limits, extensions will be built to connect with transmission lines north and south of the city. These extensions branching from the main-line line are referred to as taking a shape similar to the tines on a pitchfork. The main-line project is to be completed September 1.

Ford, Bacon & Davis Construction Co. of Monroe, La., a subsidiary of Ford, Bacon & Davis, Inc., New York, will serve as agent for Colorado Interstate in the engineering and inspection of pipe-line construction for the project.

Construction will be started within the next few weeks for the 8,400-hp. compressor station near Lakin containing seven 1,200-hp. units. The engineering and construction of the compressor station and dehydration plant have been contracted by Stearns Roger Manufacturing Co. With the initial compressor equipment the line will be capable of delivering 100,000,000 to 120,000,000 cu. ft. daily at 900 psi.

A contract has been let for gathering lines by Colorado Interstate to Midwestern Constructors. These lines will consist of 100 to 160 miles of pipe from 4-in. to 16-in. diameter. Work is to start in May.

Natural Gas Pipeline Lets Kansas Loop

Natural Gas Pipeline Co. of America has awarded a contract to J. R. Horrigan Construction Co. to lay a 66-mile 26-in. loop. The project is located near Garfield and Wilson, Kans. The first pipe is now arriving, but it is not expected that enough pipe will be on hand to warrant starting construction until March. In addition to selling construction equipment to Horrigan which will be used for the project, O. E. Dempsey, of O. E. Dempsey Construction Co., will have complete charge of the work; field operations will be supervised under his direction by U. G. Ralph, general superintendent.

Warterfield Heads Consulting Firm

Floyd E. Warterfield, Jr., is president, and Thomas E. Jones is vice president of the newly organized Oklahoma Engineering Co., 1210 Mercantile Bank Bldg., Dallas. Warterfield has been 23 years with Stand-

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WICHITA FALLS - TEXAS

ard Oil Co. (New Jersey) subsidiaries in pipe-line engineering and executive capacities; chief engineer, purchasing agent and director, Oklahoma Pipe Line Co. (now Interstate Oil Pipe Line Co.); and vice president, Plantation Pipe Line Co., supervising design and operation. Jones is president of Oklahoma Contracting Co. The purpose of Oklahoma Engineering Co. is to offer a broad service which will cover all phases of pipe-line station and terminal-construction design and supervision. It is already organized so as to be capable of handling large projects as "turn key" jobs. The company is incorporated to act as agent for the owner in cases where this is desired. The company is prepared to handle crude-oil, product, and natural-gas pipe lines and attendant facilities.

Monterrey Line to Start in March

Construction of a natural-gas pipe line from Weslaco field in Hidalgo County, Texas, to a point on the Rio Grande River opposite Reynosa, Mexico, is expected to be started in March by Reynosa Pipe Line Co.

C. H. Gee, company representative, said the right-of-way is now being purchased. The line is expected to be completed in May.

Construction on the extension of this line to Monterrey, Mexico, to be built by Gas Industrial, S.A., also will start in March. The entire project will be constructed of 14-in.; 30 miles from Hidalgo County fields to Reynosa and 135 miles from Reynosa to Monterrey.

Socony-Vacuum Considers Sioux Falls-Fargo Project

Socony-Vacuum Oil Co., Inc., is considering plans for the construction of a 235-mile 6-in. products line with a capacity of 14,000 bbl. daily from a connection with its present system near Sioux Falls, S. D., to Fargo, N. D.

California Contractors Merge in New Firm

Pacific Pipeline Construction Co. and Engineers, Ltd., have formed a partnership for conducting a general pipe-line construction business under the name Pacific Pipeline & Engineers, Ltd. The new partnership brings together all of the facilities of two pipe-line construction organizations.

Pacific Pipeline Construction Co. has been active in California oil and gas line construction. Engineers, Ltd., constructed the Shell Oil lines from Bakersfield to Martinez and have handled several major pipe-line projects in South America. They also constructed portions of the Big Inch lines and Tennessee Gas & Transmission Co. lines.

According to B. M. Laulhere, Jr., the management and policies of the new partnership will be the same as for Pacific Pipeline Construction Co.

Boyd Becomes Partner In R. H. Fulton & Co.

J. J. Boyd has joined R. H. Fulton & Co. as partner and will make his headquarters at the company's office at Lubbock, Tex. The company is

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MORRISON BROS CONSTRUCTION CO INC
P. O. BOX 4106 ODESSA, TEXAS PHONE 1640

now finishing 60 miles of 18-in. near Dumas, Tex., for Panhandle Eastern Pipe Line Co. and Job 4 on the Standard Oil Co. (Ind.) Illinois-Minnesota products line.

Boyd has severed his connection with O. E. Dempsey interests. The partnership, known as B-K Construction Co., in which Boyd participated with O. E. Dempsey, has been closed. Dempsey continues to operate the O. E. Dempsey Construction Co.

California Project Gets 9 Miles Per Week of 30-In.

The 30-in. pipe for the 214-mile line of Southern Counties Gas Co. and Southern California Gas Co. is being manufactured by Consolidated Steel Corp. at the rate of 9 miles per week, according to the New York Times.

Fabrication involves the first use on the West Coast of the continuous-weld process.

Steel plates 30 ft. long and 92 ft. wide are fed into a series of machines which press them into cylinders, weld the edges and stretch the tube by water pressure to the 30-in. diameter. A 30-ft. joint of pipe is completed every 4¼ minutes.

The X-raying of welds, developed in wartime shipyards, is being used to test the finished product.

The 30-ft. joints are welded into 60-ft. sections which are transported to the field after being yard coated and wrapped.

Pennsylvania Officials Ask Delay in Big Inch Sale

Resolutions memoralizing Congress to hold up sale of the Big Inch pipe lines by the War Assets Administration have been presented in both the senate and house of the Pennsylvania Legislature.

WAA proposes to open bids February 8 for the second time under a policy of selling the government-owned lines to the highest bidder without restrictions as to use. Pennsylvania fears the adverse effect on its coal industry which would result from purchase and use of the lines for the movement of gas from the Southwest.

The resolutions were presented to the Pennsylvania Legislature in Harrisburg after a group of legislators conferred with Gov. James Duff to enlist his support of the move. The resolutions said use of the lines for gas would create serious unemployment in Pennsylvania by displacing thousands of persons in coal and associated industries.

The question of whether Congress will interfere to halt the sale of the lines was studied last week by a House committee in Washington. Pennsylvania's congressmen are backing proposals delaying disposal.

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For crude, products, natural gas and water lines. Sizes 6-inch to 20-inch. Other types in sizes 2-inch to 26-inch.

*Patent pending.

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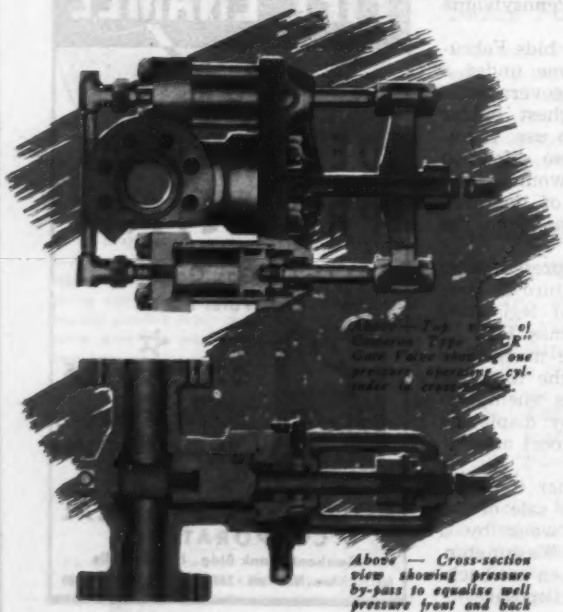

Above — Cross-section view showing pressure by-pass to equalize well pressure front and back of gate, resulting in 4 to 1 ratio of well pressure to closing pressure.

The Cameron Type "HCR" (High Closing Ratio) Pressure-Operated Gate Valve employs the same proven pressure operating mechanism as the Cameron Type "QRC" Blowout Preventer. Pressure cylinders, parallel to the gate bore on opposite sides of the body, and with piston rods attached to a yoke member which, in turn, is attached to the valve gate screw, open and close the gate as operating pressure is applied to the cylinders. The Type "HCR" Valve provides the same high ratio of closing pressure to well pressure as is provided by the Type "QRC" Blowout Preventer, i.e., 1000 lbs. pressure will close the Type "HCR" Valve against approximately 8000 lbs. well pressure. This more favorable ratio is obtained by providing a well pressure by-pass on the lower side of the gate so that pressure is equalized on the front and rear of the gate. The ratio of opening pressure to well pressure is 4 to 1, so that the valve may be easily opened under high well pressure should it become necessary to relieve pressure thru a flow-line.

Such proven mechanical features of the Cameron Type "DV" Pressure-Operated Gate Valve as: Self-feeding gate packing element to assure a seal; double-choke ports to reduce sand cutting at final closure; no delicate sealing surfaces; no cavities to collect cuttings and thus prevent closure; and others have been retained in the new valve.

Cameron Type "HCR" Valves are available only in 4" and 6" sizes, API Series 1500-10,000 Lbs. Test Pressure. They are especially recommended for flow-line service; however, the 6" size may also be used as a drilling gate above 7" o.d. casing.

Complete details will gladly be sent to interested operators on request.

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NATURAL GAS

Proposed Gas Lines Total 3,000 Miles

APPLICATIONS pending or approved for natural-gas expansion call for a total of nearly 3,000 miles of additional pipe lines and projects announced by companies involve an expenditure of some $250,000,000, according to R. H. Hargrove, president of the American Gas Association.

In a summary of the outlook for the gas utility industry for 1947, Hargrove, who is vice president of United Gas Pipe Line Co., Shreveport, pointed out conditions favor a particularly bright forecast for natural gas. The report of the A.G.A. committee on natural gas reserves, late in 1946, showed proved reserves of 148 trillion cubic feet, and new discoveries coupled with expansion of existing fields are expected to give further assurance of lasting reserves, he said. Hargrove's report on progress made by the gas industry in 1946 was issued late last year (The Oil and Gas Journal, January 4, page 103).

"The sale by the War Assets Administration of the Big Inch and Little Inch pipe lines to one of the gas bidders would further improve the financial outlook of the entire gas industry," he continued. "Delivery of several hundred million cubic feet of natural gas daily to the eastern markets would help manufactured and mixed gas companies in the northeast in meeting peak load demands and would aid them in stabilizing costs.

"Forecasts today must be tempered by economic uncertainties. The gas industry is now in a healthy condition. It has outdistanced competition in many fields. Markets are expanding rapidly in the residential and commercial fields. The curve of industrial sales which flattened with the cessation of war production again is rising."

Today's unprecedented demand for gas will be further increased by the lifting of governmental restrictions on building, Hargrove said. Because of difficulties in obtaining materials for new construction and for extending present transmission and distribution facilities many companies have been forced temporarily to limit new service, but at least moderate relief from these shortages can be expected in 1947, he added.

New methods and operating efficiencies are resulting from the gas industry's $4,500,000 research and promotion program which will enable manufactured-gas companies to increase production capacities substantially, he said. Manufactured-gas companies are increasing productive capacity through the use of natural gas and liquefied petroleum gas to meet peak load demands.

Based on these anticipated advances, it can be conservatively predicted that utility gas customers will pass the 21,500,000 mark in the coming year, Hargrove said.

Mississippi Gas-Well Allowable Hearing Set

JACKSON.—The Mississippi Oil and Gas Board will conduct a hearing February 10 on a petition for establishing an allowable for gas wells of Gwinville field, Jeff Davis County.

A dispute over spacing regulations for gas wells is now before the State Supreme Court. Landowners in the area had sought one well to each 160 acres; operators had asked one well to each 320 acres; and a Hinds County Circuit Court set the spacing at 640 acres. The ruling has been appealed.

Natural Gas Pipeline, Texoma Expansion Plan Approved

WASHINGTON.—Natural Gas Pipeline Co. of America and Texoma Natural Gas Co. have been authorized by the Federal Power Commission to construct additions to their gas transmission facilities operated as an integrated natural-gas transmission system extending from Panhandle field in Texas and supplying market areas in Indiana, Iowa, Kansas, Nebraska, Wisconsin, and Illinois. Aggregate cost of the facilities is estimated at $23,493,987.

With the installation of these facilities, to be completed about January 1, 1949, Natural Gas Pipeline will have a capacity of about 484,000,000 cu. ft. to meet estimated peak-day sales requirements of its utility customers, including Chicago District Pipeline Co. The gas required to meet increased sales will be obtained from Colorado Interstate, Harrington & Marsh, and Shamrock Oil & Gas Co. As a result of such new supply Texoma's ability to meet further demands of Natural Gas Pipeline will be improved materially.

Facilities authorized for construction by Texoma include nine 1,250-hp. units at a compressor station near Fritch, Tex., a 1,500-hp. compressor station in Moore County, Texas, about 10½ miles of 26-in. pipe line to complete the looping of its existing main transmission line and 15½ miles of 16-in. line extending to the gasoline plant of the Shamrock Oil & Gas Co., also in Moore County.

Natural Gas Pipeline will construct a 5,000-hp. compressor station near Hooker, Okla.; 39 compressor units, each of 1,250-hp. capacity, in existing stations; and approximately 110 miles of 24 and 26-in. main loop line.

Texoma owns and operates producing facilities in Panhandle field and a gas-transmission system extending to Gray, Okla. At Gray, the gas is delivered to Natural Gas Pipeline's transmission system.

Montana-Dakota Rate Hike Not Justified, FPC Holds

WASHINGTON.—In an opinion and findings released last week, the Federal Power Commission found that Montana-Dakota Utilities Co.'s transportation costs for its Baker-Bowdoin natural-gas system in 1945 had not increased, or would not increase in the immediate future, to an extent justifying a greater common-carrier transportation rate than that prescribed by the commission March 22 of last year.

The company had been granted a rehearing when it contended that substantially increased costs of operation and maintenance had taken place since May 24, 1944, the date of conclusion of the original hearing.

Chicago District Loop Construction Authorized

WASHINGTON.—The Federal Power Commission has authorized Chicago District Pipeline Co. to construct 11 miles of 24-in. gas pipe line to complete the looping of its Crawford line extending from the vicinity of Joliet, Ill., to a connection with facilities of Peoples Gas Light & Coke Co. at the western city limits of Chicago. Cost is estimated at $750,000. The completion of the looping authorized will increase the capacity of the Crawford line from 220,000,000 to 315,000,000 cu. ft. per day.

Gas Line Being Laid

Consolidated Gas Utilities Co. has begun work on a 7-mile, 6-in. pipe line to connect a new discovery well of R. Olsen Oil Co. near Meno in eastern Major County, Oklahoma, with its trunk system between the Texas Panhandle and Wichita.

STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 1, 1947

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1947				
	Comp.	Oil	Gas	Dry	Footage	1947	1946	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	29	14	0	*15	40,927	139	143	0	0	0	0	0	0	0	0	0	0
Pennsylvania	64	26	7	†31	101,033	311	361	0	0	0	0	0	0	0	0	0	0
West Virginia	24	4	17	3	79,221	71	53	0	0	0	0	0	0	0	0	0	0
Ohio	28	5	14	9	76,350	130	90	0	0	0	1	1	0	0	1	5	6
Indiana	5	2	0	3	8,595	40	27	0	0	0	0	0	1	0	0	2	3
Kentucky	4	2	0	2	5,388	38	42	0	0	0	0	0	0	0	0	6	6
Illinois	33	22	0	11	77,900	187	182	2	0	0	5	7	7	0	0	36	43
Michigan	5	2	0	3	16,880	81	64	0	0	0	3	3	0	0	2	30	32
Kansas	47	25	7	15	153,229	244	217	2	0	1	6	9	4	0	1	29	34
Neb., Mo., Iowa	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Oklahoma	53	31	3	19	146,766	365	225	4	0	0	9	13	8	0	0	64	72
Texas	132	80	9	43	610,408	671	731	4	0	1	16	21	22	0	5	97	124
North Central	42	24	0	18	109,417	212	259	2	0	0	5	7	8	0	1	38	47
West	34	27	2	5	208,668	171	156	0	0	1	1	2	1	0	1	11	13
Panhandle	8	2	3	3	43,072	38	33	0	0	0	1	1	0	0	0	1	1
Eastern	9	4	4	1	28,825	41	68	0	0	0	0	0	1	0	0	7	8
Gulf Coast	26	14	0	12	175,996	156	175	1	0	0	5	6	10	0	2	23	35
Southwest	13	9	0	4	44,430	53	40	1	0	0	4	5	2	0	1	17	20
Louisiana	20	17	0	3	139,415	105	109	2	3	0	1	6	5	3	0	14	22
Northern	7	7	0	0	25,982	50	56	0	0	0	0	0	0	0	0	7	7
Southern	13	10	0	3	113,523	55	53	2	3	0	1	6	5	3	0	7	15
Arkansas	2	2	0	0	8,255	20	12	0	0	0	0	0	0	0	0	4	4
Mississippi	5	5	0	0	46,193	35	24	0	0	0	0	0	0	0	1	8	9
Southeastern States	1	0	0	1	6,100	5	7	0	0	0	1	1	0	0	0	5	5
Montana	2	0	2	0	4,306	16	26	0	0	0	0	0	0	0	0	3	3
Wyoming	4	1	2	1	22,240	22	17	0	0	1	1	2	2	0	1	5	8
Colorado-Utah	3	3	0	0	19,838	16	11	0	0	0	0	0	0	0	0	2	2
New Mexico	12	8	2	2	59,963	45	42	0	0	0	1	1	1	0	0	4	5
California	27	21	1	5	103,790	181	177	1	0	0	3	4	2	0	0	26	28
Total United States	500	270	64	166	1,726,797	2,722	2,561	15	3	3	47	68	52	3	11	340	406
Total previous week	521	277	71	173	1,727,062	2,222	2,093	8	0	5	69	82	37	0	8	293	338
Total Feb. 2, 1946	468	267	37	164	1,731,728			2	0	4	50	56	31	1	13	309	354

Service wells included: *15, †31.

MARKET QUOTATIONS

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.
18-18.9	$1.17	....	....	..
19-19.9	1.21	....	....	
20-20.9	1.24	$1.30	....	$1.1
21-21.9	1.28	1.32	....	1.1
22-22.9	1.32	1.34	....	1.2
23-23.9	1.35	1.36	....	1.2
24-24.9	1.39	1.38	$1.61	1.2
25-25.9	1.43	1.40	1.63	1.2
26-26.9	1.46	1.42	1.65	1.2
27-27.9	1.50	1.44	1.67	1.3
28-28.9	1.54	1.46	1.69	1.3
29-29.9	1.57	1.48	1.71	1.3
30-30.9	1.61	1.50	1.73	1.3
31-31.9	....	1.52	1.75	1.3
32-32.9	....	1.54	1.77	1.41
33-33.9	....	1.56	1.79	1.43
34-34.9	....	1.58	1.81	1.45
35-35.9	....	1.60	1.83	1.47
36-36.9	....	1.62	1.85	1.49
37-37.9	....	1.64	1.87	1.51
38-38.9	....	1.66	1.89	1.53
39-39.9	....	1.68	1.91	1.55
40 and above	....	1.70	1.93	1.57

*For crude from Daboval, El Campo, and Sandy Point. †Includes Lea County, New Mexico.

Quotations shown here are f.o. plant in tank cars and in cents per ga as of last Monday.

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-7
Mid-Continent*	7.375-7.625	6.750-7.00
Tex. Gulf Coast	7.50-7.75	6.750-7.12
New York Harbor	9-10.75	8-9.2

*Basic Oklahoma Group 3. †193 F.R. (research method).

NATURAL GASOLINE

Grades—	26-70	18-5
Oklahoma (Group 3)	5.125	6.15
E. Texas (f.o.b. plant)	4.625	5.55
W. Louisiana (f.o.b. plant)	4.875	5.850

CRUDE-OIL PRICES

Representative posted schedules per bbl

East Texas	$1.7
Kettleman Hills, California*	1.6
Beauregard Parish	1.6
Illinois Basin	1.8
Pecos County, Texas (Yates)	1.4
Bradford, Pennsylvania	3.6
Eastern Ill., and Western Ind.	1.6
Tomball, Texas Gulf Coast	1.8

Note: Crude prices exclusive of sub ch

A.P.I. REFINERY REPORT

*Week ended January 25, 1947
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks Gasoline	Distillate	Residual
East Coast	732	20,905	17,768	6,865
Appalachian	170	3,607	578	402
Ill., Ind., Ky.	811	19,255	4,574	3,204
Okla., Kan., Mo.	406	9,600	1,937	1,147
Inland Texas	220	3,935	399	782
Tex. Gulf Cst.	1,125	15,462	9,407	6,221
La. Gulf Cst.	336	5,580	3,319	1,700
N. La., Ark.	64	2,123	518	113
Rocky Mtn.	139	2,448	447	562
California	817	16,886	11,410	27,292
Total 1-25-47	4,820	99,801	50,357	48,558
Total 1-18-47	4,776	98,013	52,726	50,539
Total 1-26-46	4,507	101,783	29,360	35,293

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of crude*
January 25, 1947	221,655,000
January 18, 1947	221,144,000
January 26, 1946	220,544,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Feb. 1 crude oil	B. of M. Jan. demand	Jan. 25 crude oil
Alabama	850	1,200	900
Arkansas	79,200	76,000	78,400
California	884,000	838,000	900,500
Colorado	37,080	33,000	37,020
Eastern	63,000	64,200	65,500
Florida	245	200	240
Illinois	195,900	209,000	200,500
Indiana	17,600	19,000	18,100
Kansas	284,700	260,000	285,300
Kentucky	27,700	28,000	27,700
Louisiana	415,375	382,000	416,675
North Louisiana	101,750	.....	103,050
South Louisiana	313,625	.....	313,625
Michigan	43,705	46,000	45,415
Mississippi	87,350	62,000	87,500
Montana	21,010	24,000	21,050
Nebraska	700	800	700
New Mexico	103,000	98,000	103,000
Oklahoma	365,150	375,000	364,650
Texas	1,931,615	2,030,000	1,931,615
District 1 (Southwest)	19,085	.....	19,085
District 2 (Southwest)	133,110	.....	133,110
District 4 (Southwest)	206,525	.....	206,525
District 3 (Gulf Coast)	412,175	.....	412,175
District 5 (Eastern)	33,700	.....	33,700
District 6 (Eastern)	99,435	.....	99,435
East Texas field	301,000	.....	301,000
District 7C (West)	27,585	.....	27,585
District 8 (West)	464,725	.....	464,725
District 7B (W. Central)	34,000	.....	34,000
District 9 (N. Central)	118,225	.....	118,225
District 10 (Panhandle)	82,050	.....	82,050
Wyoming	103,040	93,000	105,280
Miscellaneous	.....	600	.....
Total United States	*4,661,220	4,640,000	4,690,045

Change from prev. wk., down 28,825

Total production January 1-February 1..... †149,281,560 bbl.

Same period last year (crude plus condensate) .. 155,309,940 bbl.

*Not incl. 25,260 bbl. condensate. †Incl. 808,320 bbl. condensate.

CRUDE-OIL STOCKS 221,655,000 bbl. as of January 25—up 511,000 bbl. One year ago 220,544,000 bbl.

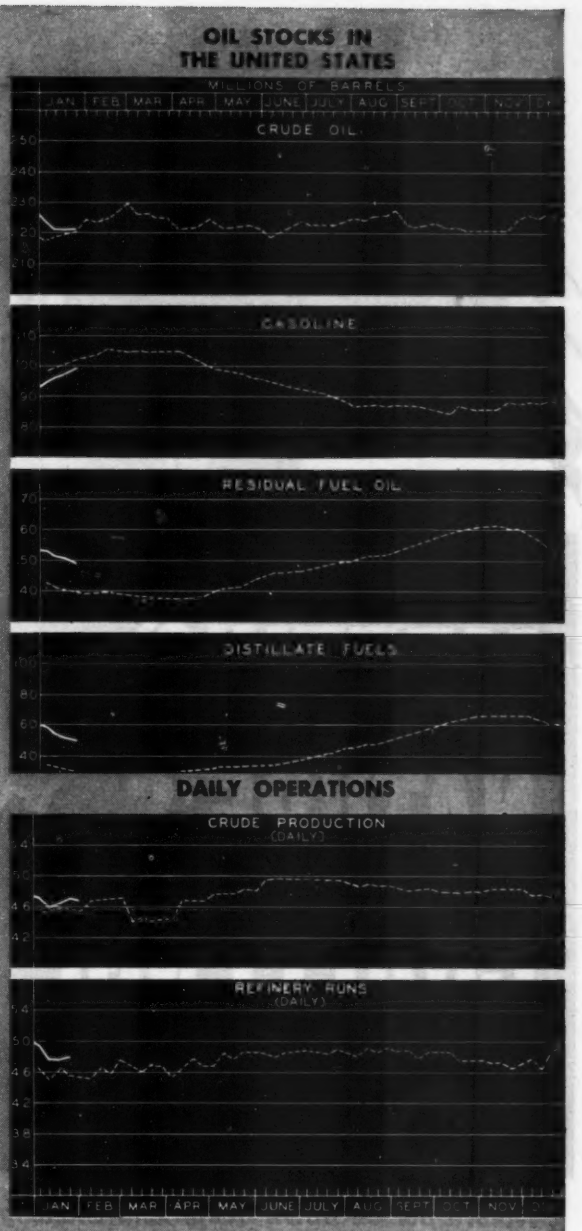
GASOLINE STOCKS 99,801,000 bbl. as of January 25—up 1,788,000 bbl. One year ago 101,783,000 bbl.

RESIDUAL FUEL-OIL STOCKS 48,558,000 bbl. as of January 25—down 1,981,000 bbl. One year ago 35,893,000 bbl.

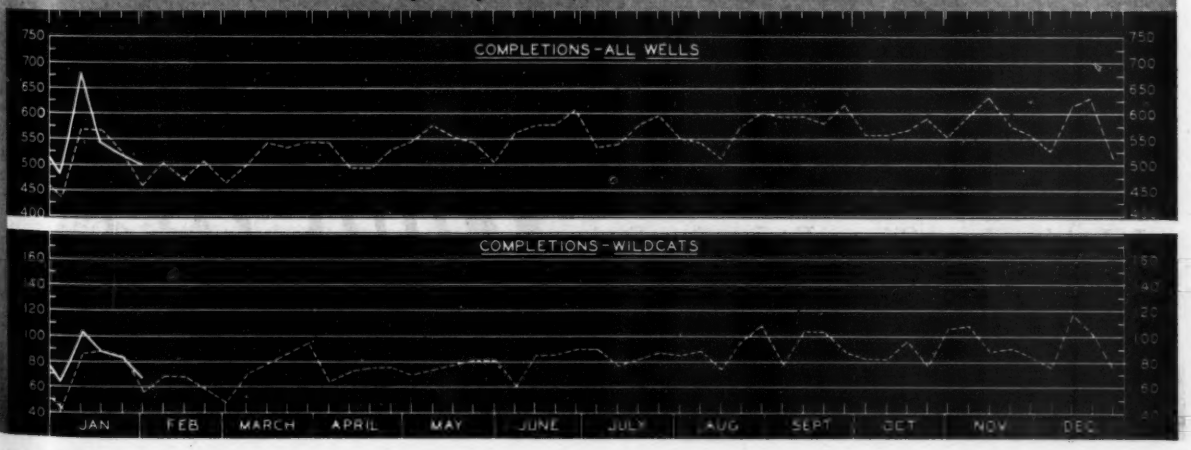
GAS OIL AND DISTILLATE STOCKS 50,357,000 bbl. as of January 25—down 2,369,000 bbl. One year ago 29,360,000 bbl.

CRUDE-OIL PRODUCTION 4,661,220 bbl. as of February 1—down 28,825 bbl. One year ago 4,563,340 bbl.

REFINERY RUNS 4,820,000 bbl. daily week ended January 25—up 44,000 bbl. One year ago 4,507,000 bbl.



Solid line charts weekly completions, service wells in Eastern area included.



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Exploration and Drilling

Anadarko Basin Discovery Recheck

by Charles J. Deegan

LAST week there was a substantial let down in the excitement over Sohio Petroleum Co.'s discovery in Garvin County, Oklahoma, in the southeast end of the Anadarko basin. This well, 1 Howard, SE SE NW 17-1n-2w, had stirred up so much rumor about 1,000 to 3,000-bbl.-per-hour performances, that the official announcement of 100-bbl.-an-hour performance through open 2½-in. tubing, and 33 bbl. per hour through ¼-in. choke, acted as a severe damper on the enthusiasm that had developed.

This week, there is a calmer and more realistic appraisal of its meaning and performance, as well as the geological conditions revealed in the log, as thus far made public. Also there is a certain amount of speculation about some things that have not been made clear by the company's official announcements. Most geologists figure that Sohio naturally wants to take all the advantage it can out of information gained at considerable expense, and therefore has every reason to retain some of the data, particularly as to interpretation.

Taking the data revealed by the company, elevation 1,087 ft., top of McLish dolomite 10,202 ft., Basal Bromide sand 10,060 ft., Simpson 9,526 ft., Viola 8,903 ft., Sylvan (Sycamore) 8,571 ft., Hunton (middle or lower) 8,514 ft., Woodford 8,024 ft., Mississippi Caney 7,630 ft., and Pennsylvanian Springer 6,087 ft., speculation starts.

The one obvious fact is that the interval between the Woodford and Hunton looks reasonably normal, and indicates there was no unconformity to uncover Hunton and subject it to erosion and porosity development, such as occurred at West Edmond. On the other hand, a 57-ft. thickness of Hunton definitely indicates that a full section of Hunton was not cut. This is verified by the company's announcement that while not definitely tagged, the Hunton section cut was middle or lower. This would indicate most likely that a fault was drilled through, catching only a small portion of the Hunton section. This sounds reasonable enough for the type country.

Another known fact is that original estimates were that the Bromide sand would be found 2,500 to 3,000 ft. higher than actual. Since this is such steep dip country, located practically on part of the mountain folding, it would be easy to misinterpret the formation from which reflections were being obtained.

Just how important this might be is hard to estimate. The results apparently vindicated the structural interpretation of the reflection data, even if the depth was off. Sohio is known to have run velocity surveys in the well, and therefore is in an excellent position to reinterpret its seismic data. Rumors that seismic data indicated a graben may of may not be correct. Indirect confirmation might be indicated by official statements that future development was expected to prove the structure complicated.

Regardless of these questions, the fact remains that 140 ft. of saturated sand was found in the Basal Bromide, with no free water, and apparently the top 32 ft. of the McLish contains no water. There is indirect evidence that the sand was hard, as the Bromide usually is in this part of the country, being dolomitic and limy instead of shaly. Porosity and permeability data on all the cores taken would naturally be welcomed by all interested parties, and give a better opportunity to appraise the importance of the discovery.

In the meantime, it appears that a pretty substantial strike has been made, and the well appears to have a good "kick" so far. Tubing pressure buildup was about normal for a well that was still not at its top pressure (from 800 pis. through ½-in. choke after 36 hours, to 1,100 psi. through a ⅛-in. choke after an additional 36 hours), considering the completion method of hanging tubing in the casing without any seal between casing and tubing.

SOUTHWEST TEXAS

New Shallow Producing Area Opened in Calhoun Co.

CORPUS CHRISTI.—A new shallow producing area for Calhoun County, offshore in Matagorda Bay, has been opened in The Texas Co. 1 State-Amerada Unit, in Section 106. Operators drilled to a total depth of 11,530 ft., plugged back and perforated with 19 shots from 4,970-78 ft. A drill-stem test open 2 hours and 27 minutes through ¼-in. chokes on top and bottom, with a 1,050-ft. water cushion, flowed the cushion, then flowed 42 bbl. of 26.3°-gravity oil with 3 per cent b.s. and w. Bottom-hole pressure flowing was 2,125 lb., with bottom-hole shutin pressure of 2,175 lb. The new discovery is 4½ miles northeast of Port O'Connor.

The first oil field for Kennedy County has been reported in the making at Atlantic Refining Co. 1 McGill, wildcat in the northwest corner of the county. Drilled to a depth of 9,905 ft., trouble developed, lost returns, and set 5½-in. casing at 9,904 ft. for production tests. Tests of the deeper zones failed and the 5½-in. pipe was pulled and the 9⅝-in. casing, previously set at 7,998 ft., was perforated at 7,676-80 ft., with 48 shots for the drill-stem test which flowed oil in 2 hours and 10 minutes, with 500 lb. working pressure, through a ¼-in. choke. Operators changed to a 3/16-in. top choke, cleaned 3 hours and 15 minutes with 700 lb. working pressure, then changed to 5/32-in. choke and flowed at the rate of 180 bbl. of 39°-gravity oil per day with 2 per cent b.s. and w. When the tool was pulled, it recovered 4,200 ft. of oil and 730 ft. of salt water. These perforations were then squeezed and operators were preparing to reperforate higher.

In northwest part of Edwards County, the newly discovered Holman pool has been opened by J. O. Rogers Oil Co. 1 J. S. Holman et al, located in the GCSD&RGNG Survey 24. Drilled to a total depth of 1,010 ft., plugged back to 580 ft., this well was completed through open hole 548-80 ft. for an initial production of 2 bbl. of 14°-gravity oil per day on pump.

A new pay for the Agua Dulce field, Nueces County, has been brought in by L. M. Lockhart 2 F. & G. Prochaska, located in V. L. de Herrera Grant, 5 miles northeast of Banquet. Total depth is 6,650 ft., with top of the pay at 6,585 ft. On initial production flowed 141 bbl. of oil per day through an 11/64-in. choke, through perforations at 6,596-98 ft. Gas-oil ratio 6,280 ft., gravity 42°.

There were 35 new locations reported this week, 12 of which are wildcats, 4 in Starr, 2 in Atascosa, and 1 each in Bell, Jim Wells, Kleberg, McMullen, Wilson, and Zapata counties. Ten wildcats were completed, one opened a new pool in Edwards County and one a new pay in Agua Dulce field. The remaining eight were dry.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

Edwards County: New oil discovery, Holman pool—J. O. Rogers Oil Co. 1 J. S. Holman et al, GCSD&RGNG Sur. 24, in NW part of Edwards County, top pay 548 ft., TD 1,010 ft., PB 580 ft.,

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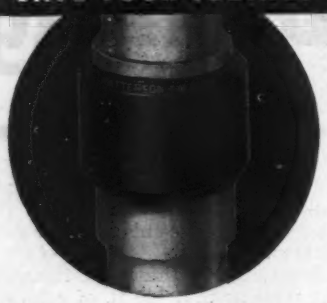

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open hole 548-80 ft., IP 2 bbl. per day on pump, gravity 14°.

Nueces County: New oil pay, Agua Dulce field—L. M. Lockhart 2 F. & G. Prochaska, in V. L. de Herrera Grant, 5 mi. NE of Banquete, top pay 6,585 ft., TD 6,650 ft., perf. 6,596-98 ft., IP 141 bbl. oil per day through 11/64-in. choke, gas-oil ratio 6,280, TP 1,580 lb., CP 2,400 lb., gravity 42°.

SOUTHWEST TEXAS WILDCAT FAILURES

Bee County: Wm M. Nicholls 1 Homer Harris, in P. Wilcox Sur., 10 mi. W of Beeville, dry, TD 4,582 ft.

Live Oak County: Stanolind Oil & Gas Co. 1 Alamo Lbr. Co., in N. Navarro Sur. 326, 3½ mi. SE of Suniland, dry, TD 9,384 ft.

Nueces County: Southern Minerals Corp. 1 Hugo Isensee, in BS&F Sur. 407 dry, TD 7,514 ft.

San Patricio County: Jones & Morgan 1 W. E. Reese, in John Pollan Sur., 2 mi. NW of Sinton, dry, TD 7,007 ft.

Starr County: Dan Auld & W. W. Carter 1 Lazaro Pena et al, in Pedernal Grant, 23 mi. NW of Roma, dry, TD 2,319 ft.

Uvalde County: Bennett & Sorrells 1 Mary Rehm, in Peter Fricker Sur. 870½, 10 mi. SW of Sabinal, dry, TD 4,505 ft.

Williamson County: M. M. McDowell 1 R. A. Mueller, in H. Goode Sur., 6 mi. SE of Thrall, dry, TD 1,728 ft.

Zapata County: Government Wells Oil Corp. 1 Cuellar Bros. in TCRR Sur. 245, 30 mi. NE of Zapata, dry, TD 1,342 ft.

EASTERN TEXAS

Interest Focused on Delta's Paluxy Test in Smith County

DALLAS. — Delta Drilling Co.'s Paluxy test, the 1 H. G. Lyon, 2½ miles northeast of Lindale in northwest Smith County, was drilling ahead, after finding water in the Woodbine at 5,519 ft. The Paluxy is expected around 7,000 ft. This well is watched with considerable interest as it was reported running high to a Woodbine failure drilled by Humble Oil & Refining Co. in 1938, which had top of the Austin at 4,990 ft. on an elevation of 476 ft. Delta's test, on an elevation of 536 ft., reported the Austin at 4,660-75 ft., from samples.

Two wildcat operations still testing are Humble's 1 McKnight, in Wood County, which had total depth at 10,943 ft. Contents of cores taken at 9,143-9,213 ft. were not disclosed. In Cherokee County, Standard Oil Co. of Texas 1 New Birmingham, northwest of Maydelle, recovered salt water, mud, and some gas at 9,914-23 ft., and scheduled a test higher in the Travis Peak.

Two new wildcat tests getting under way are R. J. Caraway and Jay Simmons 1 Mullinax, 10 miles northwest of the Hawkins field, on what is known as the Peach block, in the Mary Polk Survey. Work will start early in February and it is scheduled to drill to 8,300 ft., which is expected to put it some 200 ft. into the Paluxy. In Harrison County, 10 miles southeast of Marshall, and 1 mile northeast of the Cross Roads community, Edgar Johnston, Longview, Tex., had derrick up at the 1 Edna Hood, in the Lucinda Wallace Survey. Location is midway between Travis Peak production on the west side of the Waskom field and the 1 Furrh estate, drilled by R. W. Williams west of the Elysian field, which had some indications of oil in the Travis Peak.

EAST TEXAS WILDCAT FAILURE

Madison County: Sun Oil Co. 1 J. A. Fannin, Thomas Boatright Sur., 4 mi. SW of Madisonville, dry, TD 3,065 ft., logged show of oil in Wilcox at 2,258-68 ft., no oil recovery on drill-stem test, cap rock 2,910 ft., elev. 274 ft.

PERMIAN BASIN

Monahans Has Fourth Producing Zone in Prospect

MIDLAND.—A fourth producing zone for the Monahans field of northeastern Ward County was in prospect last week at Stanolind Oil & Gas Co. 14-A Sealy Smith, in the G&MMB&A Survey, and 2 miles east of the field itself. A drill-stem test at 8,872-9,000 ft. in the Silurian, open 75 minutes, recovered 60 ft. of gas-cut mud and approximately 150 ft. of oil-cut mud. The mud tested 5 per cent oil and operators prepared to set plug at 8,860 ft. before running casing for a production test. Total depth is 9,033 ft. Present formations having production are the Taff, Clear Fork and Ellenburger. Stanolind has staked two offsets: the 17-A Sealy Smith being to the south, and 18-A Sealy Smith, a west offset. Both tests will go to 9,500 ft. to test all formations. Stanolind 1-B Sealy Smith, 2½ miles northwest of Monahans, was reported ready to abandon operations at plugged-back total depth of 6,415 ft. On the southeast flank of Monahans, Shell Oil Co., Inc., completed its 17 Sealy Smith for 278 bbl. of oil in the Ellenburger at 10,180-313 ft. Location is in Section 22, Block A, G&MMB&A Survey.

In Pecos County, Pure Oil Co. 1 J. S. Oats, 20 miles southwest of Fort Stockton, which was intended to be a water well to support deepening operations at the company's 1 Harrison, last week was producing 50 bbl. of 18°-gravity oil and 300 bbl. of water a day from the Rustler limestone in the Cretaceous at 845 ft. Operators were undecided as to disposition of the well. The 1 Harrison is an old cable-tool test to 5,000 ft., and now scheduled to be deepened to 10,000 ft.

Activity at the new Irish (Clear Fork) field in southwestern Hale County showed an additional 100 ft. of Clear Fork without encountering water at Stanolind's 1 S. C. Durrett, southeast offset to the 1 Lee Irish, discovery well. The Durrett well swabbed 55 bbl. of oil in 6 hours, with no water, after acid treatment at 5,923-69 ft. Tubing pressure is 1,100 lb., and casing pressure 900 lb. Stanolind's 2 Blackmon, ¾ mile west and ¼ mile north of the 1 Irish, was below 4,680 ft. in limestone, on last report.

In southeastern Hale County, Stanolind's 1 Fisher, Wolfcamp discovery on the north flank of the buried granite mountain range extending east and west across the north end of the Permian basin, was making potential tests. In 6 hours it averaged 32½ bbl. of 40°-gravity oil from 6,895-6,992 ft. Stanolind was reported to be planning two offset tests, but details and locations were not disclosed. Location of the 1 Fisher is 7 miles west and slightly north of a 6,760-ft. dry hole that found the Canyon

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lime dry at 6,150 ft., and 11 miles south and slightly west of a dry hole that had dry Canyon at 5,860 ft., and carried to 10,250 ft., into the pre-Cambrian.

WEST TEXAS SUCCESSFUL WILDCAT

Gaines County: B. H. Nolan 1 Jones, Sec. 2, Blk. H, D&W Sur., 1 mi. N of Cedar Lake field, flowed 7,500,000 cu. ft. gas a day, Yates sand 2,925-36 ft., shut-in casing pressure 2,000 lb., TD 2,926 ft., elevation 3,567 ft.

WEST TEXAS WILDCAT FAILURE

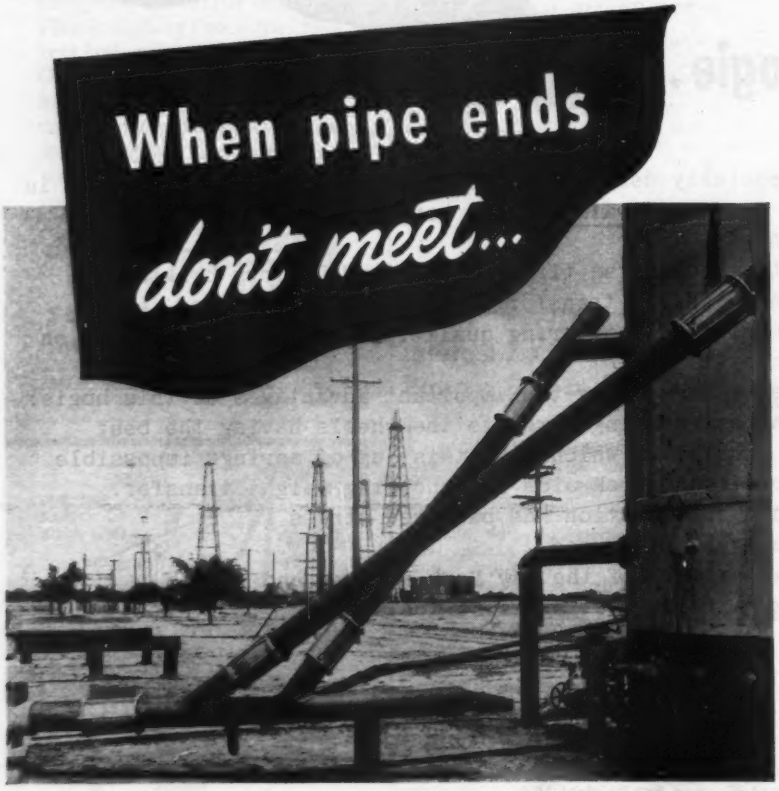
Kent County: Humble Oil & Refining Co. 1 O. N. Blair, Sec. 44, Blk. 5, H&GN Sur., 1½ mi. SW of Polar discovery, dry, TD 7,925 ft., San Andres 1,595 ft., Clear Fork 2,680 ft., Mississippian 7,60) ft., Ellenburger 7,817 ft., elev. 2,305 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—The Texas Co. 1 W. C. Garrett, 22-16s-38e, 8 miles northeast of the Lovington pool, Lea County, recovered 7 ft. of dolomite with scattered porosity and bleeding oil in a core at 5,362-70 ft. A drill-stem test at that depth put gas to the surface in 35 minutes, and at the end of 2 hours had recovered 65 ft. of drilling mud with a small amount of oil and gas in the upper portion. Operators then cored 14 ft. of hard dolomite at 5,370-83 ft., with no shows. On last report it was to ream the hole out.

Devonian Oil Co.'s wildcat, the 1 Federal-Browne, 19-9s-38e, some 20 miles northwest of the Landool field of Cochran County, Texas, was installing pump to complete. Production is from the San Andres at 4,945-5,012 ft., total depth. After three acid treatments, it was swabbing at the rate of 10 bbl. of oil an hour and approximately 1 bbl. of salt water.

Sun Oil Co. 1-B McKinley, deepening operation in the old Hobbs field, recovered 170 ft. of mud and water, and 5,369 ft. of sulfur water, with no shows of oil, in a drill-stem test at 7,920-8,010 ft. Shell Oil Co., Inc. 2 Rinewalt, 4-22s-37e, had new total depth at 6,620 ft. and flowed 198 bbl. of fluid in 24 hours, cutting 6 per cent water and 2 per cent basic sediment.



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SOUTH LOUISIANA

Lockport Pool Gets New Oil Pay

NEW ORLEANS.—A new oil pay has been opened in the Lockport pool of Calcasieu Parish by Magnolia Petroleum Co. 7 Freiberg & Wolf, 9-10s-9w. Drilled to a total depth of 7,700 ft., with perforations at 7,490-94 ft., this well flowed 85 bbl. of oil per day through a 9/64-in. choke, tubing pressure 875 lb., gas-oil ratio 2,341, gravity 39°.

Also in Calcasieu Parish, Union Sulphur Co., Inc. 1 J. G. Gray Estate, 17-11s-10w, opened a new gas-condensate pay for Bayou Choupique pool. On initial test flowed 22 bbl. of condensate per day through 8/64-in. choke, and 1,988,000 cu. ft. of gas. Gravity of condensate 49°. No water in the flow. Ratio 92,000, tubing pressure 3,125 lb. Total depth 9,500 ft.

A new gas-condensate pay for Lake Hermitage pool, Plaquemines Parish, has been opened by Gulf Refining Co. 16 Lafourche Basin Levee district, 11-18s-25e. Drilled to a total depth of 12,100 ft., flowed 143 bbl. of condensate per day through a 3/16-in. choke and 3,455,000 cu. ft. of gas per day, through perforations at 12,022-36 ft. Gravity 45°.

A new oil sand for Barataria pool, Jefferson Parish, was opened by The California Co. 1 Rathbone Land Co., 2-16s-23e, through perforations at 8,930-38 ft. Total depth is 10,700 ft., and on initial production flowed 250 bbl. of 36°-gravity oil per day through a 9/64-in. choke, gas-oil ratio 816, tubing pressure 1,500 lb.

Humble Oil & Refining Co. 1 Hibernia Bank & Trust Co., 68-10s-14e, opened a new gas-condensate pay for Laurel Ridge pool, Iberville Parish, and extended production ¾ mile east, when it flowed 89 bbl. of condensate per day through a ⅛-in. choke, and 1,306,200 cu. ft. of gas. Ratio 14,630, tubing pressure 3,425 lb., gravity 61°. Total depth is 10,660 ft. and production is through perforations at 10,172-178 ft.

Shell Oil Co., Inc. 1 Myles Salt Co., 37-14s-6e, produced from a new sand for Weeks Island dome in Iberia Parish. On initial gage flowed 446 bbl. of 33°-gravity oil in 24 hours through a 10/64-in. choke with a gas ratio of 1,253. Total depth is 12,415 ft., and pipe is perforated with 60 shots from 12,380-395 ft.

The Texas Co. 56 State-Lake Pelto on State Lease 188, in the Lake Pelto field of Terrebonne Parish, was drilled to a total depth of 10,486 ft., and was completed flowing a potential of 205 bbl. of 36°-gravity oil in 24 hours through an 8/64-in. choke. Production is through perforations at 10,836-880 ft.

There were 14 new locations this week, all in proven areas. Ten of the completions were producers while three were dry. Calcasieu and Plaquemines parishes received the greatest activity.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Calcasieu Parish: New gas-condensate pay, Bayou Choupique pool—Union Sulphur Co., Inc. 1 J. G. Gray Estate, 17-11s-10w, ¼ mi. N of 1 Ellender, discovery well, TD 9,500 ft., PB 8,628 ft., perf. 8,612-16 ft., IP 22 bbl. condensate per day through 8/64-in. choke, and 1,988,000

cu. ft. gas per day, ratio 92,000, TP 3,125 lb., gravity 49°, no water.

Calcasieu Parish: New oil sand, Lockport pool—Magnolia Pet. Co. 7 Freiberg & Wolf, 9-10s-9w, TD 7,700 ft., perf. 7,490-94 ft., IP 85 bbl. per day through 9/64-in. choke, TP 875 lb., gas-oil ratio 2,341, gravity 39°.

Iberville Parish: New gas-condensate pay, Laurel Ridge pool—Humble 1 Hibernia Bank & Trust Co., 68-10s-14e, ¾ mi. E extension to production, TD 10,660 ft., perf. 10,172-178 ft., IP 89 bbl. condensate per day through ⅛-in. choke and 1,306,200 cu. ft. gas per day, ratio 14,630 ft., TP 3,425 lb., gravity 61°.

Jefferson Parish: New oil sand, Barataria pool—The California Co. 1 Rathborne Land Co., 2-16s-23e, TD 10,700 ft., top sand 8,930 ft., perf. 8,930-38 ft., IP 250 bbl. per day through a 9/64-in. choke, gas-oil ratio 816, TP 1,500 lb., gravity 36°.

Plaquemines Parish: New gas-condensate pay, Lake Hermitage pool—Gulf 16 Lafourche Basin Levee district, 11-18s-25e, TD 12,100 ft., perf. 12,022-036 ft., IP 143 bbl. condensate per day through a 3/16-in. choke, and 3,455,000 cu. ft. gas per day, ratio 24,722, TP 3,750 lb., gravity 45°, no water.

SOUTH LOUISIANA WILDCAT FAILURE

Calcasieu Parish: Sun Oil Co. 3 Hunter Co., 23-9s-11w, west flank of Edgerly pool, dry, TD 9,370 ft.

N. CENTRAL TEXAS

Shackelford County Gets First Mississippi Production

WICHITA FALLS.—Standard Oil Co. of Texas Collin County exploration test, just north of the town of Frisco, apparently had found its objective last week at 7,583 ft. in dolomite. According to unofficial information, it is the Ellenburger, and cores taken to 7,583 ft. have been hard, tight limestone, with only a slight show of oil.

First Mississippi production for Shackelford County was brought in last week at Central Pipeline Co. 1 A. L. Sanders, in the Sanders deep pool. When water developed in the Ellenburger, the well was plugged back to 4,457 ft., acidized at 4,421-57 ft., and flowed at an estimated 75 to 100 bbl. of oil a day.

In southern Young County, 7½ miles northwest of Eliasville, Warren Petroleum Corp. 1 Bulah Martin found a show of oil in limestone at 3,531-36 ft., and on a 1-hour drill-stem test at that depth recovered 1½ bbl. of heavily oil-cut mud and 10 bbl. of salt water. A previous test in the Caddo at 3,523-31 ft., it showed gas at the surface in 30 minutes, and in 1 hour recovered 1½ bbl. of salty, oil-cut mud. Bottom-hole pressure was 1,375 lb. in 15 minutes. Operators were drilling ahead below 3,565 ft.

Six miles north of Throckmorton, Konrad Sztykgold 1 Roy B. King set casing at 5,091 ft. After perforating with 60 shots at 4,990-5,030 ft. and running the swab once, the well kicked off and flowed 60 bbl. of fluid in 1 hour. Water was estimated to be 25 per cent of the flow but was decreasing at the end of the hour. Further tests were to be made. Meanwhile, Sztykgold staked location for a ½-mile northeast offset, at the 2-B King, which is slated to go to 5,500 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCATS

Young County: Nu-Enamel Oil Operating Co. 1 Sally Donnell, Sec. 1,205, J. C. Shelton Sur., 2 mi. NW Eliasville, flowed 47 bbl. a day, 15/64-in. choke, sand 2,332-42 ft., TD 2,342 ft., elev. 1,114 ft.

Archer County: Cochran & Cain 1 Virgil Seay "D," J. W. Harris Subd., 10 mi. W Archer City, pumped 35 bbl. oil a day and 25 bbl. water, sand 1,384-89 ft., TD.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Clay County: Chas. R. Rider 1 Taylor, BBB&C Sur., ¾ mi. E Dean, dry, TD 6,000 ft., conglomerate with light odor 5,897 ft.

Wichita County: The Texas Co. 1 Seffie Foster, Stephen Denison Sur., 10 mi. W Burk, dry, TD 1,902 ft. in shale.

Wilbarger County: The Texas Co. 1 H. E. Houser, W. Alston Sur., 2 mi. E Oklaunion, dry, TD 7,800 ft. in lime, sandy lime with some saturation 6,900-20 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Callahan County: Arthur R. McElreath, Jr. 1 T. W. Eastham, Sec. 9, Blk. 5, SPRR Sur., 2½ mi. SE Admiral, dry, TD 892 ft.

Palo Pinto County: Fortex et al 1 S. J. Stewart & Son, Sec. 50, Blk. 4, T&P Sur., 11 mi. NW Strawn, dry, TD 1,870 ft. in water sand.

Stonewall County: Standard Oil Co. of Kansas 1 Dora McMeans, Sec. 172, Blk. "D," H&TC Sur., 2 mi. NE Swenson, dry, TD 6,333 ft., Dotham 2,820 ft., Saddle Creek 3,110 ft., Flippen sand 3,170 ft., Flippen limestone 3,190 ft., Caddo 6,026 ft., no Palo Pinto, Ellenburger 6,235 ft.

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TEXAS GULF COAST

Second New Hackberry Sand Pool Opened

HOUSTON.—The second new Hackberry sand pool to be opened in Orange County by Hinkle Drilling Co. is at the 1 Miller-Vidor Land Co., located in J. M. Swisher Survey 2, 9 miles north of the North Port Neches field. The well is producing gas and condensate through a ⅛-in. choke with 2,800 lb. pressure through 36 perforations in the Hackberry sands at 7,772-78 ft. Total depth is 7,910 ft. with 5½-in. casing cemented approximately 100 ft. off the bottom.

Eli Marks 1 A. B. Cohn Estate, wildcat off the west flank of production on the Esperson Dome, and just over the line in Harris County, Meredith Duncan Survey, is preparing to complete in the upper sands. Tanks and separators are being moved to the location. Sand section being tested is from 8,670-8,700 ft. Production is through 32 perforations at 8,687-95 ft., where it cleaned through a 3/16-in. choke with 2,700 lb. flowing pressure, flowing gas and condensate. Total depth is 9,094 ft., and the 5½-in. casing is cemented at 9,086 ft. Numerous tests were made from open hole at the bottom where it flowed 52°-gravity dark-colored condensate with 3,275 lb. pressure on an initial try. Bridge plug is set at 9,070 ft. for the present test.

Floyd L. Karsten 1-A W. P. Gann, wildcat test 2 miles north of production in the South El Campo field of Wharton County, is preparing to make tests from several other sands after showing salt water from the deepest sand through perforations at 6,620-24 ft. An initial test of the well through perforations at 5,678-82 ft., indicated a new gas-condensate discovery when it flowed through a 10/64-in. choke with 1,850 lb. working pressure on a the drill-stem tool. Total depth is 7,203 ft. and 5½-in. casing is cemented at 6,660 ft.

There were 15 new locations reported this week with 2 being wildcats, 1 each in Fayette and Liberty counties. There were 11 completions reported, 4 oil, 1 condensate and 6 dry holes. Only one wildcat, a dry hole, was completed in Jefferson County.

UPPER GULF COAST TEXAS WILDCAT FAILURE

Jefferson County: Fidelity Oil & Royalty Co. 1 Hebert Trust et al, in Seabreeze area in T&NO Sur., 3 miles southeast of Seabreeze production, dry, TD 10,- for repairs at 3,861 ft. Cores 3,562-70 ft. recovered 4 ft. 10-in. of gray shale having a sour gas odor; and 2 in. of white fine-grained sandstone with no shows. Six inches recovered between 3,570-78 ft. was firm sandstone with salty taste.

FLORIDA WILDCAT FAILURE

Monroe County: Gulf Refining Co. 1 State-Lease No. 374, NE NW SE SW 15-67s-27e, dry, TD 6,100 ft., no tops reported.

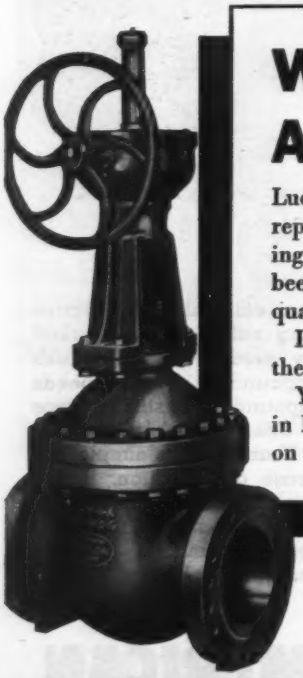
MISSISSIPPI

Gulf's Amite Wildcat Coring Below 10,695 Ft.

JACKSON.—Wildcat drilling reports last week included Gulf Refining Co. 1 J. A. Rowland, 39-4n-2e, Amite County, which was coring below 10,695 ft., with no shows. Electric-log tops are Wilcox 4,892 ft., Midway 8,102 ft., Clayton 9,610 ft., Selma 9,688 ft., Austin 10,092-414 ft., and the Tuscaloosa, by cores, at 10,605 ft.

In Jones County, Gulf Refining Co. 1 L. L. Major, 29-6n-11w, had total depth at 8,310 ft., and was coring below 8,414 ft. A side-wall core at 8,134 ft. was said to have shown oil. Oil-bearing sands, as placed by electric log, are 7,910-22 ft., 7,956-70 ft., and 8,129-50 ft.

In Issaquena County, Warren Petroleum Co. 1 J. S. Heath, 9-10n-8w, was shut down



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APPALACHIAN FIELD

Kermit District Gets Large Brown Shale Gasser

PITTSBURGH.—In Kermit district, Mingo County, West Virginia, one of the largest Brown Shale gas wells of record was completed by the United Fuel Gas Co. as 5,831 Burning Creek & Marrowbone Land Co. was deepened to 3,180 ft. where the total gage was 15,349,000 cu. ft. At 2,565 ft. the shale gas gaged 1,555,000 cu. ft.

In Slab Fork district, Wyoming County, Owens - Libby - Owens Gas Department topped the Corniferous lime at 6,468 ft. in 746 Western Pocahontas Corp. lease which from a surface elevation of 1,785 ft. places it —4,683 ft. This is 87 ft. lower on structure than a previous deep test on the same tract which topped the Corniferous at 6,614 ft. from a surface elevation of 2,018 ft. or —4,596 ft. This test was dry through the Oriskany sand.

In Reedy district, Wirt County, McCall Drilling Co. completed a test on E. F. & F. J. Moncrief farm with a final gage of 2,903,000 cu. ft. of gas from the Berea topped at 2,377 ft., gas 2,379 ft., rock pressure 500 lb. 24 hours, total depth 2,387 ft.

In Big Sandy district, Kanawha County, Falling Rock Producing Co. completed 60 fee with a final open flow, natural, of 5,250,000 cu. ft. of gas; Corniferous lime 4,979 ft., Oriskany 5,100 ft., gas 5,106-25 ft., total depth 5,125 ft. In Elk district, Glenn Dearth completed a test, N. W. Cavender, which gaged 2,113,000 cu. ft. of gas, after shot with the surface elevation 779 ft., Corniferous lime 4,942 ft., Oriskany 5,055-5,139 ft., gas 5,065 and 5,091-93 ft., shot 5,049-5,107 ft., total depth 5,141 ft.

In Ripley district, Jackson County, United Carbon Co. completed 1,422 T. B. Harrison with a final gage of 3,559,000 cu. ft. gas, natural, with surface elevation 829 ft., Oriskany 4,974-5,007 ft., total depth 5,010 ft., rock pressure 1,040 lb. 24 hours. Here, Hope Natural Gas Co. completed 9,066 Otis Shinn with a gage of 2,252,000 cu. ft. of gas after shot with the surface elevation 651 ft., Corniferous lime 4,736 ft., Oriskany 4,830 ft., gas 4,833 ft., shot 4,833-53 ft., rock pressure 1,720 lb. 24 hours, total depth 4,857 ft.

In Teays Valley district, Putnam County, Teavee Oil & Gas Co. completed a test, James Fletcher, with a gage of 1,852,000 cu. ft., Injun sand, total depth 1,926 ft. In Union district, Godfrey L. Cabot, Inc. completed 1,214 J. L. McLean Heirs, which gaged 2,970,000 cu. ft. of gas, after shot, from the Oriskany said. The Corniferous lime was logged at 4,980 ft., Oriskany 5,081-93 ft., gas 5,083-90 ft., shot 5,082-92 ft., rock pressure 1,830 lb. 28 hours, total depth 5,101 ft.

New work totaled 21 locations and in Scott district, Boone County; Birch and Otter districts, Braxton County; Buffalo district, Brooke County; Washington district, Calhoun County; Elk district, Kanawha County; Harts Creek and Jefferson districts, Lincoln County; Union district, Ritchie County; Geary and Reedy districts, Roane County; Grant district, Wayne County; Clay and Reedy districts, Wirt County; Union district, Wood County; Baileysville and Oceana districts, Wyoming County.

In Summit Township, Erie County, northwest Pennsylvania, Sylvania Gas Corp.

opened up new possibilities as the wildcat on H. G. Hull farm gaged 1,436,000 cu. ft. if gas from the Oriskany sand. The Tully lime was logged at 1,860-1,964 ft., Onondaga lime 2,084 ft., Oriskany 2,329 ft., gas 2,333 and 2,335-36 ft., where the test was shut down.

In Fallowfield Township, Washington County, Thomas Myers et al completed a test, Samuel Redd, which gaged 786,000 cu. ft. of gas with the Gantz sand 1,997-2,031 ft., gas 2,008 ft., Fifty Foot sand 2,062 ft., gas 2,117-21 ft., total depth 2,174 ft.

New locations totaled seven, in Patton Township, Allegheny County; Kiskiminitas Township, Armstrong County; Canemaugh Township, Indiana County; Allegheny Township, Westmoreland County.

CALIFORNIA

Standard's Discovery Regarded as Important

LOS ANGELES.—Standard Oil Co. of California's discovery of a new deep pay zone in Kettleman Hills Middle Dome is generally regarded as one of the most important oil-field developments in this state in recent years. There has been no commercial production on the Middle Dome for some time, although in the thirties about a half million barrels were produced from the Temblor zone (Miocene).

The new well, 73-30V Middle Dome, was brought in from the Eocene, flowing on test at an estimated rate of 500 to 1,000 bbl. of 35°-gravity oil. It was drilled to 12,389 ft., with 6⅝-in. casing cemented at 10,921 ft. Drill pipe is stuck in the hole from 10,971 to 12,369 ft. The test last week was made with tubing set with packer at the bottom of the casing. Well is now shut in with surface pressure at 1,900 lb.

Standard acted as contractor in drilling the well for the Kettleman Middle Dome Association. Standard and Bolsa Chica Oil Corp. are the principal members of the association which was formed about 15 years ago as a unit plan. Standard has about a 75 per cent interest, with Bolsa Chica owning most of the balance. Warner Clark, Standard engineer, is president of the association.

A new Kern County deep test, about 1 mile east of the town of McKittrick, will be spudded soon by E. A. Parkford who has staked location for a wildcat in 22-30s-22e. easing activity in the McKittrick area has been brisk for several months, especially since Texas Co.'s oil discovery on the Belgian anticline in 29-30s-22e last summer. Tide Water Associated has drilled 5-32 Midway-McKittrick about 1 mile south of this discovery, but recent formation tests have not been encouraging.

In a second attempt to extend production to the west in the Trico gas field, Lebow & McNee have staked location for 1 McDonald in 19-24s-23e on the west flank of the field and about 1¾ miles southeast of its recently abandoned 1 Hacienda. Shell Oil Co., Inc., last week completed 3 Alpaugh unit at the northwest end of the field flowing 6,600,000 cu. ft. from the upper zone and 4,000,000 cu. ft. from the lower zone.

Lloyd Corp.'s 61-34 Houchin in 34-31s-26e on the north flank of the Paloma field is a failure at 11,825 ft. All tests were wet. Western Gulf Oil Co., however, should soon complete its No. 16-6 well on the northeast flank of the field in 6-32s-27e, thereby extending production a short distance in that direction.

Less than 1,000 ft. of drill pipe fish remain in Pacific Western Oil Corp.'s world's record well, 1 National Royalties in Kern County, and contractor is continuing to cut and pull with the intention of eventually resuming drilling. The well now holds another record. The cut this week was the deepest outside cut ever made.

Thirty-three new California locations were announced last week, 10 less than in the previous week. Six are wildcat locations.

CALIFORNIA WILDCAT FAILURES

Orange County, Irvine area: Almeria Industries Co. 1, 20-6s-8w, dry, TD 2,343 ft.

Tulare County, Terra Bella area: J. R. Smith, R. H. Larson and Gene Reid Drilling Co. 1 Smith, 7-23s-28e, dry, TD 588 ft.

Kern County, Premier area: Standard Oil Co. 1-3 Tyson, 20-28s-27e, dry, TD 3,460 ft.

CALIFORNIA SUCCESSFUL WILDCAT

Kings County: New oil pay, Kettleman Hills Middle Dome—Kettleman Middle Dome Association, Standard of California, Operator 73-30V, 30-23s-19e, TD 12,389 ft., 6⅝-in. casing to 10,921 ft., 3-in. tubing w./pkr. at 10,599 ft. On test flowed in excess of 500 bbl. 35°-gravity oil per day from Eocene through a 24/64-in. choke. Shut-in surface pressure 1,900 lb.

LA.-ARK.

Lake St. John Gets Year's First Completion

SHREVEPORT.—Completion of Stanolind Oil & Gas Co. 1 Fred Wappler, 2-17n-16w, as a dual producer from the Pettit and Travis Peak zones, was expected last week. This test, located northeast of the town of Greenwood in Caddo Parish, made an estimated 25,000,000 cu. ft. of gas daily but no official test has been made on the condensate production. Operators had hoped for the flush production found recently on the west side of the Waskom field. There were no indications of further tests by Stanolind in the area.

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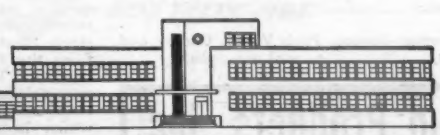

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Lake St. John field of Tensas Parish was reported last week. Mid-States Oil Corp. 3 Wentworth Washington, 15-9n-10e, flowed 254 bbl. of 40°-gravity oil in 18 hours from perforations at 9,123-37 ft.

In Arkansas, Carter Oil Co. 1 Philyall C-159, 36-16s-27w, took a drill-stem test at 5,421-44 ft. Using a 1,000-ft. water cushion, in 30 minutes it recovered the cushion, 150 ft. of salt water and 10 ft. of drilling mud slightly cut with gas. In Nevada County, Spartan Drilling Co. 1 J. M. Stocks continued testing and was pumping 75 bbl. of oil a day, plus some salt water. Location is 9-15s-22w.

CANADIAN FIELDS

Lloydminster Gets Important Extension

CHATHAM. — Extension of the Alberta section of the Lloydminster field ⅝ mile west over a width of 2 miles is indicated by Dimsdale 1, LSD 2, 14-50-2w4, completed by Lloydminster Oil Producers with oil sand at 1,980 ft. Pump is being installed for a definite production test. Commoil-Lloyd 3, LSD 6, 10-50-1w4, is being put on the pump after bailing tests at 1,953 ft. Commoil 4, LSD 11, 10-50-1w4, is rigging, and another location has been made. These wells all test a northerly extension of the earlier Alberta producing area. Two other tests are rigging in Saskatchewan and one in Alberta.

Turner Valley.—On the east flank of the Turner Valley north extension, Foothills Oil & Gas 25, finished with Madison limestone at 8,627-9,157 ft., started at 5 bbl.. an hour with booster gas, increasing to 14 bbl. Tests are continuing.

Ram River.—In the Ram River-Clearwater area in the central Alberta foothills, Ram River Oils 4, LSD 9, 36-34-10w5, bottoming in Devonian limestone at 1,460 ft., was given shots of 15 quarts and later 57 quarts in a porous zone at 1,373-95 ft. Shows of live green crude were secured, with traces of water, believed to be returning drilling fluid. The well is being cleaned out, and will be given another shot or acid treatment. Ram River 3, LSD 12, 1-37-11w5, is redrilling below 3,271 ft.

Foremost.—In the Foremost field, southern Alberta, McColl-Union 6-D, LSD 6, 25-4-10w4, finished at 3,244 ft. in the Bow Island sand, is perforating and testing, with indications of good gas production. McColl-Union 10-B, LSD 10, 22-7-9w4, located to the north and east, is drilling.

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ROCKY MOUNTAIN

New Pool in Big Horn Appears in Making

DENVER.—Another oil pool in deeper horizons on the rim of the Big Horn basin in Wyoming appears to be in the making in the Hidden Dome field in Washakie County in Ohio Oil Co. 2 OPC-2, NW SE SE 31-48n-90w. It topped the Embar lime at 4,245 ft., and in a drill-stem test at 4,245-4,300 ft., open 20 minutes, recovered 250 ft. of oil, 150 ft. of oil-cut mud, and 50 ft. of drilling mud. It is drilling ahead at 4,307 ft. with the Tensleep as the next objective. Hidden Dome is an old field in upper horizons, the discovery well being completed in the first Frontier in 1917, near the location of the Embar discovery, for 4,000,000 cu. ft. of gas per day. Subsequently it was deepened to 1,492 ft., and gas increased to 40,000,000 cu. ft. per day.

The gas field was depleted by 1932 after producing 22 billion cu. ft. Afterwards some high-gravity crude was produced in small quantities in a stray sand between the first and second Frontier. Ohio controls most of the acreage with Mackinnie Oil & Drilling Co. holding 5,000 acres around the flanks and contributing dry-hole money. The structure is on the eastern side of the basin. The Pure Oil Co. operation in the Worland, formerly called River Dome field, which is out in the basin lies only 12 miles to the west. The Pure discovery well had the top of the Embar at —5,943 ft., sea-level data, as compared with —601 ft. for the Ohio well, a drop of 5,342 ft. in 12 miles.

Steamboat Butte extension.—An important extension of the Steamboat Butte field, Fremont County, Wyoming, is imminent in Brikerhoff Drilling Co. 1 Tribal, NW NW NW 9-3n-1w, joint with Sohio Petroleum Co. It had the top of the basal Dakota sand, Lakota, at 4,452 ft. In a drill-stem test at 4,448-61½ ft., open 1 hour, gas came in in 8 minutes and in 30 minutes increased to 114,400 cu. ft. There was a recovery of 620 ft. of green oil and 62 ft. of oil and gas-cut mud. The oil, corrected to 60°, tested 42.2° gravity. The third Frontier was topped at 3,408 ft. A drill-stem test at 3,408-56 ft., open 30 minutes, showed 50,000 cu. ft. of gas and 810 ft. of water. Another test at 4,205-28 ft., open 51 minutes, showed gas in 40 minutes and a recovery of 165 ft. of green oil and gas-cut mud. It is drilling ahead below 4,540 ft. The well is located 1 mile to the southeast of the nearest Lakota sand well, and a slightly shorter distance from the nearest Tensleep sand producer. The field produces from the Frontier, Lakota, Sundance, Embar, and Tensleep sands. This is the first well drilled in the field by interests other than British-American Oil Producing Co., which brought in the discovery in 1943. Production to date is in excess of 4,000,000 bbl. from nine wells. The extension well is 2½ miles from the most northerly producer.

Rangely field.—The formula recommended by the operators engineering committee of the Rangely field for prorating production to hold it down to pipe-line capacity of 26,000 bbl. daily is expected to go into effect February 1. Allowables will be determined on the basis of acreage held by the respective operators, bottom-hole pressures, and gas-oil ratios instead of specified amounts per well per day applicable to all wells in the field, which for January was 135 bbl. per day. Until the field is unitized some operators favored one well to 80 acres, allowing credit for an adjoining 40 upon which no well has been drilled if it is 1,700 ft. from another operator's line, while some opposition was expressed by those who have already drilled up their leases with a well to 40 acres.

Continental Oil Co.'s two edge wells on the west side which appeared noncommercial in the upper Weber failed to improve upon drilling deeper. Its 4 Dorothy Rooth, C NW NW 22-2n-103w, was deepened from 6,965 to 7,255 ft., 340 ft. in the Weber. Last drill-stem test at 7,169-7,255 ft., open 3 hours, recovered 6,294 ft. of mud and salt water. Its 3 Dorothy Rooth, C NE NE 27-2-103, was deepened to 7,140 ft., 464 ft. in the Weber, and drill-stem tests showed only water. Both will be plugged back for further testing.

Stanolind Oil & Gas Co. 2 Hefley, SW NE NW 2-1n-102w, outpost on southeastern side of the field, swabbed 378 bbl. of oil in 34 hours, 80 the last 12 hours, and is still testing. Top of Weber was at 5,C85 ft., and total depth 6,323 ft. It was shot with 210 qt. at 6,234-6,318 ft.

Drilling record for the field was reported in California Co. 29 McLaughlin, NE NW 13-2-103, completed at 6,540 ft. for 337 bbl. in 24 hours. It spudded December 2, and was completed January 19, a total of 48 days. Loffland Brothers had the contract.

Cut Bank lime wells.—Texas Co. 1 Blackbear, C SW SW 29-35n-6w, an outpost on the west side of the Cut Bank field in Montana, failed to encounter any shows in the Cut Bank sands at 3,135-93 ft., and will be drilled deeper to test the Madison. It is located 6 miles southwest of the nearest Madison lime well in North Cut Bank. Union Oil Co. 8 McGuinness Unit, SW NE NW 6-35n-5w, was completed in the Cut Bank sand at 2,872 ft. for 8,600,000 cu. ft. of gas per day. It is a twin well to 7 McGuinness which swabbed 65 bbl. of 40°-gravity oil from the Madison at 3,035-84 ft., but was plugged back and completed as a gasser in the Cut Bank and the other well drilled to test the lime. However, it was decided to save the twin well as a gasser and go back into 7 McGuinness, shut off the gas, and test the lower horizon. It is located 2½ miles south of the nearest Madison producer and will be an important extension.

Haystack Mountain test.—Dyer & Rice 1 Bruning, SW SW 28-2n-70w, Haystack Mountain, north of the old Boulder field, Colorado, topped the Frontier sand at 2,462 ft., and in a drill-stem test at 2,498 ft. recovered 90 ft. of oil-cut mud. The horizon also showed gas, but the sand had practically no permeability. It is drilling ahead at 2,955 ft. in the Muddy, and will go to the Morrison.

New operations.—Twelve new operations were reported, of which one was in the Rangely field and a wildcat in Montezuma County in Colorado; two in Mush Creek, and one in Crook's Gap, Byron, Beaver Creek, Kirby Creek, Hamilton and Big Muddy, in Wyoming; and one each in Cut Bank and Cedar Creek, in Montana. The Colorado wildcat is Jack Harris 1 Government, C NE 22-35n-15w, Point Lookout District, Montezuma County, southwestern Colorado. Location is about 4 miles south and east of a group of shallow wells drilled a number of years ago several of which produced small quantities of gas which was used locally at depths ranging from 350 to 1,000 ft. Mancos shale of Cretaceous age is at the surface.

Completions.—Nine wells were completed of which four were oil wells with initial

production of 1,243 bbl., four were gas wells and one was a dry hole. Colorado had three completions, all oil wells, initial production 795 bbl., all in the Rangely field. Wyoming had four completions, of which one was an oil well in the Lost Soldier field for 448 bbl. in 17 hours, one was a gas well in Beaver Creek in Stanolind Oil & Gas Co. 5 Unit which extended the field a mile to the north, and two were wildcats.

WYOMING SUCCESSFUL WILDCAT

South Sand Draw, Fremont County: Sand Draw Oil Co. 1-T Unit, NE SW NE 26-32n-95w, TD 4,650 ft., est. 20,000,000 cu. ft. of gas from 1st, 2nd and 5th Frontier sands through perforations. Top 1st. Frontier 4,015 ft., 2nd, 4,105; 3rd., 4,301; 4th., 4,460; 5th., 4,555 ft., elev. 6,864 ft.

WYOMING WILDCAT FAILURE

Seven Mile, Carbon County: Wasatch Oil Refining Co. 1 Government, SE SE NW 28-22n-88w, TD 3,257 ft., top Tensleep 2,160 ft., dry.

KANSAS

Drilling Activity Increases In Western Kansas

THE favorable results of tests on several wildcats throughout the state offset the previous decline in successful wildcat activities in Kansas this week. Considerable interest centered around Cities Service 1 Becker, NE SE NW 32-23s-15w, Pawnee County, which recovered 90 ft. of oil and 800 ft. of oil-and gas-cut mud on a drill-stem test in the Lansing-Kansas City zone logged at 3,582 ft., and sour gas on subsequent tests in the Arbuckle formation. The well is located approximately 1½ miles southeast of the Benson pool, which was opened late in 1945 by the Stanolind & Skelly 1 Benson, a Lansing-Kansas City producer.

In Ellis County, the Skelly Oil 1 Allen, SE SE SW 22-11s-19w, discovery well of the Northeast Solomon pool, has been officially assigned a potential of 323 bbl., and physical potential is being taken now on Stanolind Oil & Gas 1 Irvin, SE SE SE 6-14s-19w, the **Irvin pool opener**, which made 141 bbl. of oil on a pump test recently. Also in Ellis County two offsets to the Northwest Burnett pool discovery are in progress: Continental 1 Watkins, NW SW NW 2-11s-18w, is drilling below 2,200 ft., Shell Oil 1 Ridler "E," SW NW NW of the same section, is drilling below 2,800 ft., while just across the Rooks County line in SE SW SE of Section 35-10s-18w, Sunray Oil 1 Wilson, northeast offset to the opener, logged the Arbuckle at 3,504 ft. and is setting 5-in. pipe in that formation. The pool was opened by Continental Oil 1 Mortgage, SE NE NE 3-11s-18w, which has made a 3,000 bbl. potential showing on depthograph test this past week.

Completions for the week totaled 47, including 25 oil wells, 7 gas wells, and 15 dry holes; 2 of the oil wells, 1 gasser and 6 of the failures were wildcats. New locations total 33, 26 development wells and 7 wildcats.

KANSAS SUCCESSFUL WILDCATS

Harvey County: Stanolind Oil & Gas 1 Brandenberger, SW NE SW 12-24s-3w, pumped 15 bbl. of 25.1°-gravity oil per day from Viola at 3,875-80 ft.; Lansing-Kansas City 2,538 ft., Mississippi lime 3,364 ft., Kinderhook 3,666 ft., Misener 3,786 ft., Hunton 3,788 ft., Simpson dolomite 3,893 ft., Simpson sand 3,898 ft., Arbuckle 3,984 ft., TD 4,018 ft.

Kearny County: Stanolind Oil & Gas 1

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Horizontal drain holes greatly increase the total drainage area of an oil well. They also provide unimpeded passages for the oil to travel from all directions into the central bore. Slow and uniform drainage, insured by horizontal holes, greatly reduces tendency of the gas to by-pass the oil. The spacious drainage channels also act as underground collecting chambers in which the gas in solution is separated from the oil under decreased pressure and velocity and to a large extent re-enters the formation. This preservation of the formation pressure will enable the well to produce at a much higher rate without exceeding the limits of efficient production.

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WELL DRILLING

Ross Unit, SW SW SW NE 34-21s-35w, produced 812,000 cu. ft. gas from Permian at 2,498-2,526 ft. and 2,628-62 ft., Herrington 2,633 ft., Krider 2,644 ft., Winfield 2,684 ft., Ft. Riley 2,796 ft., TD 2,830 ft.

Rice County: W. L. Hartman 1 Linke, C E/2 NW SE 36-19s-10w, pumped 75 bbl. of oil per day from Arbuckle at 3,275-76 ft.; Lansing-Kansas City 2,950 ft., conglomerate 3,271 ft., Simpson 3,267 ft., TD 3,276 ft.

KANSAS WILDCAT FAILURES

Butler County: Hipple Estate et al 1 Janzen, SW SW NE 6-23s-3e, dry, TD 3,280 ft., Lansing-Kansas City 2,120 ft., Kinderhook 2,964 ft., Misener 3,064 ft., Hunton 3,068 ft., Maquoketa 3,112 ft., Viola 3,140 ft., Simpson 3,190 ft., Arbuckle 3,249 ft.

Gove County: Jones & Shelburne et al 1 Hewitt, C SW NW 15-13s-30w, dry, TD 4,768 ft., anhydrite 1,830 ft., Heebner 3,845 ft., Lansing-Kansas City 3,872 ft., Basal Kansas City 4,162 ft., conglomerate 4,482 ft., Mississippi lime 4,485 ft., Viola 4,701 ft., Arbuckle 4,745 ft.

Rice County: Keyes Drilling 1 Hager, NW NE SW 17-19s-10w, dry, TD 3,370 ft., Topeka 2,601 ft., Heebner 2,877 ft., brown lime 2,995 ft., Lansing-Kansas City 3,024 ft., conglomerate 3,317 ft., Arbuckle 3,361 ft.

Russell Maguire 1 Potwin, SW SW NW 9-20s-7w, dry, TD 3,677 ft., Lansing-Kansas City 2,868 ft., conglomerate 3,284 ft., Kinderhook 3,319 ft., Misener 3,532 ft., Viola 3,537 ft., Simpson 3,606 ft., Arbuckle 3,659 ft.

Sedgwick County: Russell Maguire 1 Evans, NE NE SW 23-26s-1w, dry, TD 3,617 ft., Kansas City 2,641 ft., Mississippi lime 3,112 ft., Kinderhook 3,399 ft., Misener 3,490 ft., Viola 3,491 ft., Simpson 3,507 ft., Arbuckle 3,597 ft.

Woodson County: Kenneth Rupp 1 Lauber, SW SW NE 18-26s-15e, dry, TD 1,414 ft., Mississippi lime 1,412 ft.

OHIO, KENTUCKY

Good Discovery Indicated In Muskingum County

COLUMBUS.—Indications of the best oil discovery to be found in Ohio since the Hemlock Grove pool discovery, was brought in by Nollem Oil & Gas Co. on R. H. Hartman, Section 34, Blue Rock Township, Muskingum County. The Clinton sand was reached at 4,551 ft. and at 4,565 ft. the hole had filled 3,000 ft. with oil, which has not been lowered, although swabbed until all tanks were filled while being drilled through the sand. The sand was soft and the big pay was at 4,554-71 ft. The well is 1 mile northeast of the Bloom pool and 2 miles southwest of the recent gas discovery on William Miller in Section 36 Blue Rock.

In Salt Creek Township, Muskingum County, Industrial Gas Corp. found 2,304,000 cu. ft. of gas in the Clinton sand on the 1 Everett Coffey, Section 15. The sand was topped at 4,092 ft. and paid to 4,103 ft. where the well was shut down for a test.

The new gas pool east of Woodsfield was extended ½ mile to the south by another good well. Kirkman and Spence 1 M. A. Strickling, Section 21, Center Township, Monroe County, was drilled 8 ft. into the Berea sand, topped at 1,928 ft., where the well gaged 1,600,000 cu. ft.

The Wheeling pool was further extended ½ mile to the west by Ohio Fuel Gas Co. 1 Clifford Booth, Section 3, Knox Township, Guernsey County. Oriskany pays at 3,117-21 ft. and 3,125-28 ft. were shot, and when shut in gaged 712,000 cu. ft.

Four locations were reported in Stark County and 13 more were scattered over

the state. Lancaster field led in completions with seven, followed by Ashland, Cambridge, and Sandyville with six each, Stewart three, and Brush Creek one.

OHIO WILDCAT FAILURE

Tuscarawas County, Oxford Township: Ohio Fuel Gas Co. 1 Cecile Cramlet, Sec. 13, Clinton 4,969-93 ft., TD 5,077 ft.

WESTERN KENTUCKY

OWENSBORO.—Exploratory activity in the western Kentucky area continues to remain at a very low level with only one active wildcat reported during the past week. This was the Ryan Oil 1 L. R. Waitman, 6-P-29, Daviess County, which is preparing to set pipe on the Cypress sand at 1,488-96 ft., total depth 1,824 ft. Coring from 1,493-99 ft. resulted in the recovery of 5 ft. of saturated sand and 1 ft. of hard sand with no shows. A drill-stem test of the interval, however, was unsuccessful. From a surface elevation of 382 ft., an electric log indicated the top of the Tar Springs at 1,196 ft., Glen Dean at 1,249 ft., Paint Creek at 1,525 ft. and the Ste. Genevieve at 1,652 ft.

Four completions were reported in the western Kentucky area during the week. These consisted of two oil wells and two dry holes, none of which were wildcats. Only two new operations were reported during the week, one each in Clay and Henderson counties.

INDIANA

EVANSVILLE.—The Sam Malis 1 Fleener, NE SW SW 22-3s-12w, showed prospects of opening a new oil field 4 miles south of the Owensville pool in Gibson County during the past week when a 1-hour drill-stem test of the McClosky lime recovered 90 ft. of oil-cut mud with no water. Saturation was encountered in the McClosky at 2,648-54 ft. and 2,682-88 ft. Oil shows were also found in the Waltersburg sand at 1,863-69 ft., but the packer failed to hold during a drill-stem test of the zone and operators went ahead to test the McClosky. Pipe has now been set to make conclusive tests of both formations.

First Benoist production in the new Princeton Townsite pool has been definitely assured by the Henry Smith et al 1 E. Hunt, NW SW NW 8-2s-10w. Following a 40-qt. shot in the Benoist at 1,931-45 ft., total depth, the well is making approximately 7 bbl. of oil an hour during cleaning out operations. The remaining wells in the field are producing from the Cypress sand.

Indiana operators completed five wells during the past week, two of these being oil wells and the remainder dry holes. No exploratory completions were reported. Seven new operations were announced during the week, and these were located four in Gibson County, two in Knox and one in Pike. Included in the new operations was the A. J. Slagter, Jr. 1 Yockum, 9-2n-10w, a Knox County wildcat which is now drilling below 10-in. surface pipe set at 75 ft.

MICHIGAN

Severe Winter Weather Handicaps Operation

SAGINAW.—Midwinter's grip kept Michigan oil field completions down to five in the past week, the list showing three dry-hole wildcats, a 100-bbl. producer in Algoma Township, Kent County, and a 24-bbl. well in Isabella Township, Isabella County.

Operators announced 16 new oil and gas locations, 4 in Allegan County, 3 each in Kent and Isabella, 1 each in Huron, Livingston, Mecosta, Osceola, Ottawa and Van Buren.

Production data prepared by the Michigan Oil & Gas Association showed the continuing moderate decline in daily output, December output from 3,520 wells averaging 42,896 bbl. For the first time Arenac County's Deep River field was in the top spot with a daily average of 7,753 bbl. from 101 wells, nudging the Reed City pool's 190 wells at 7,530-bbl. daily average from the Reed City field's 2-year top spot.

MICHIGAN WILDCAT FAILURES

Gladwin County, Hay Township: J. O. Mütch 1 James Geering, NE NW SW 20-18n-1e, dry in Dundee, TD 3,653 ft.

Lake County, Chase Township: Byron MacCallum-1 Lake County Farm, SW SW NE 10-17n-11w, dry in Detroit River, TD 3,774 ft.

Montcalm County, Pine Township: Gordon Oil Co. 1 John S. Powell, NW NE NE 2-11n-8w, dry in Dundee, TD 3,408 ft.

ILLINOIS

Marion County Wildcat May Open New Field

MATTOON.—National Associated Petroleum Corp. 1 George Boye, NW NE NW 21-4n-4e, is showing promise of opening a new field for Marion County. This well, located approximately 6 miles north of the newly discovered Omega field, is now being cleaned out and tested in the Aux Vases sand at 2,202-12 ft., total depth. Prior to shot, the well is swabbing at the rate of about 1 bbl. an hour. Although it is not a big producer, it is likely that the well will cause additional drilling in the area.

Four new oil pools, four extensions to

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pools, and five new pays in pools were discovered in Illinois in January according to the monthly drilling report issued by the Illinois State Geological Survey. New pools as classified by the report were Kenner North and Stanford West in Clay County, Newton West in Jasper County and Lexington in Wabash County. Extensions were completed to the Ewing pool in Franklin County, Junction North in Gallatin County, Mt. Erie South in Jasper and Cowling in Edwards. The new producing strata are the Palestine sand in the Cowling pool, Edwards County, Waltersburg sand in the Grayville pool, White County, Pennsylvanian sand in Junction North, Gallatin County, Aux Vases sand in Ewing, Franklin County, and Levias lime in Lancaster Central, Wabash County.

Wabash County, which has shown a steady increase in drilling activity for several months, led in total number of completions for January with 31 wells reported and in total number of wells drilling at the end of the month with 42. Concord, in White County, was the most active pool at the end of the month. Among the pools discovered in the last 6 months, Boos East and Browns East are leading in drilling activity at the present time.

ILLINOIS SUCCESSFUL WILDCATS

Clay County: National Associated Petroleum Corp. 1 Oak Hinkle, SE NW NE 33-3n-7e, pumped 305 bbl. oil, 1,000 gal. acid, McClosky 3,031-39 ft., TD 3,047 ft.

Jasper County: McCollough Drilling Co. 1 Winterwood, NE NE NE 10-6n-9e, pumped 8 bbl. oil, 5,000 gal. acid, McClosky 2,991-98 ft., TD 3,016 ft.

ILLINOIS WILDCAT FAILURES

Clay County: Superior 1 H. Newell, NE SE NE 2-3n-8e, dry at 3,177 ft., Glen Dean 2,521 ft., Cypress sand 2,733 ft., Benoist 2,899 ft., Aux Vases 2,971 ft., Ste. Genevieve 3,029 ft., McClosky 3,077 ft.

Coles County: John E. Carlson 1 Emery Furgeson, SE SE SE 5-12n-10e, dry at 840 ft., sand 212-18 ft.

Richland County: W. Duncan 1 Stadge-Boley, 29-3n-14w, dry at 3,283 ft., Glen Dean 2,584 ft., Benoist 3,002 ft., Ste. Genevieve 3,128 ft., McClosky 3,157 ft.

Wabash County: C. E. Skiles 1 W. B. Baird, NE SE SE 30-1n-13w, dry at 2,878 ft., Glen Dean 2,250 ft., Ste. Genevieve 2,785 ft., Rosiclare 2,841 ft.

Vic & Van Operating Co. 1 J. E. Campbell, SE SE NW 7-1n-14w, dry at 3,212 ft., Tar Springs 2,461 ft., Glen Dean 2,533 ft., Cypress sand 2,816 ft., Ste. Genevieve 3,042 ft., McClosky 3,143 ft., St. Louis 3,200 ft.

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OKLAHOMA

Caddo County Wildcat Reaches Depth Record

A NEW world depth record is in sight at the Superior Oil Co. 51-11 Weller, NW NW NE 11-8n-12w, Caddo County, which on February 3 had reached the former record of 16,668 ft. established by the Pacific Western 1 National Royalties in Kern County, California. When the Superior well reached the record depth, operators pulled drill pipe and bit to change bits and planned to drill ahead as soon as this was done. Although the well is being drilled as a tight hole, depths released by the company indicate that it has been making about 40 ft. of hole daily during the past week. Casing now in the hole includes surface pipe at 1,540 ft., 9-in. set at 10,240 ft. and 7-in. set at 16,351 ft. The string of 7-in. casing also establishes a new record, being the longest string of pipe ever set in any well.

The 51-11 Weller was spudded in May of 1946, and to date has not been held up by fishing jobs or mechanical trouble. It is being drilled in what is thought to be the deepest part of the Anadarko basin in an effort to determine the possibilities of deep oil fields in the area. Originally plans called for drilling the well to the basement or at least below 17,000 ft. provided this was possible. Present plans to continue drilling indicate that a new record may be established which will stand for several years.

Sohio Pearoleum Co. has staked a new location on its Eola block in Garvin County, approximately 3¾ miles southeast of its recent discovery, the 1 Howard in SE SE NW 17-1n-2w. The new test will be known as the 1 Kennedy, NW NW SE 26-1n-2w, and is the only location staked in the area so far.

Prospects for a new pool in Carter County improved during the past week with the recovery of 450 ft. of clean oil on a drill-stem test at the H. F. Gibson 1 Smith, NW NW SW 14-5s-1w. The zone tested was in the Deese series at a depth of 3,485-95 ft., and approximately 50,000 cu. ft. of gas accompanied the oil recovery. Gibson has ordered the well drilled deeper in hopes of finding the main Lone Grove sand section at approximately 3,600 ft.

OKLAHOMA SUCCESSFUL WILDCATS

Cotton County: Martin Properties 1 Dyer, SW SW SE 33-2s-11w, pumped 76 bbl. of 35°-gravity oil per day from sand at 1,650-53 ft.; sand 1,631-38 ft., shale 1,640-50 ft., TD 1,656 ft.

H. A. Hamilton 1 Bates, SE NW NW SE 17-3s-11w, pumped 15 bbl. of 60°-gravity oil per day from sand at 1,580-82 ft.; sand 1,560-66 ft., and 1,568-72 ft., TD 1,586 ft.

D. Gandy et al 1 Taylor, SW SE SW 34-3s-11w, produced 70 bbl. of 35°-gravity oil per day from sand at 1,445-48 ft., TD 1,448 ft.

McClain County: Wood Oil Co. 1 Henderson, SE NE NW 14-5n-2w, produced 33 bbl. of 44°-gravity oil per day from

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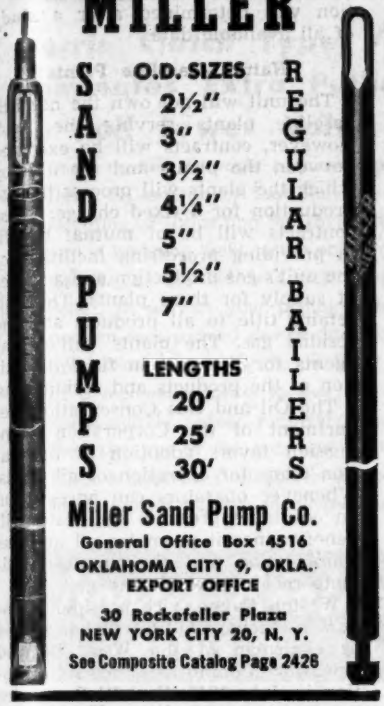

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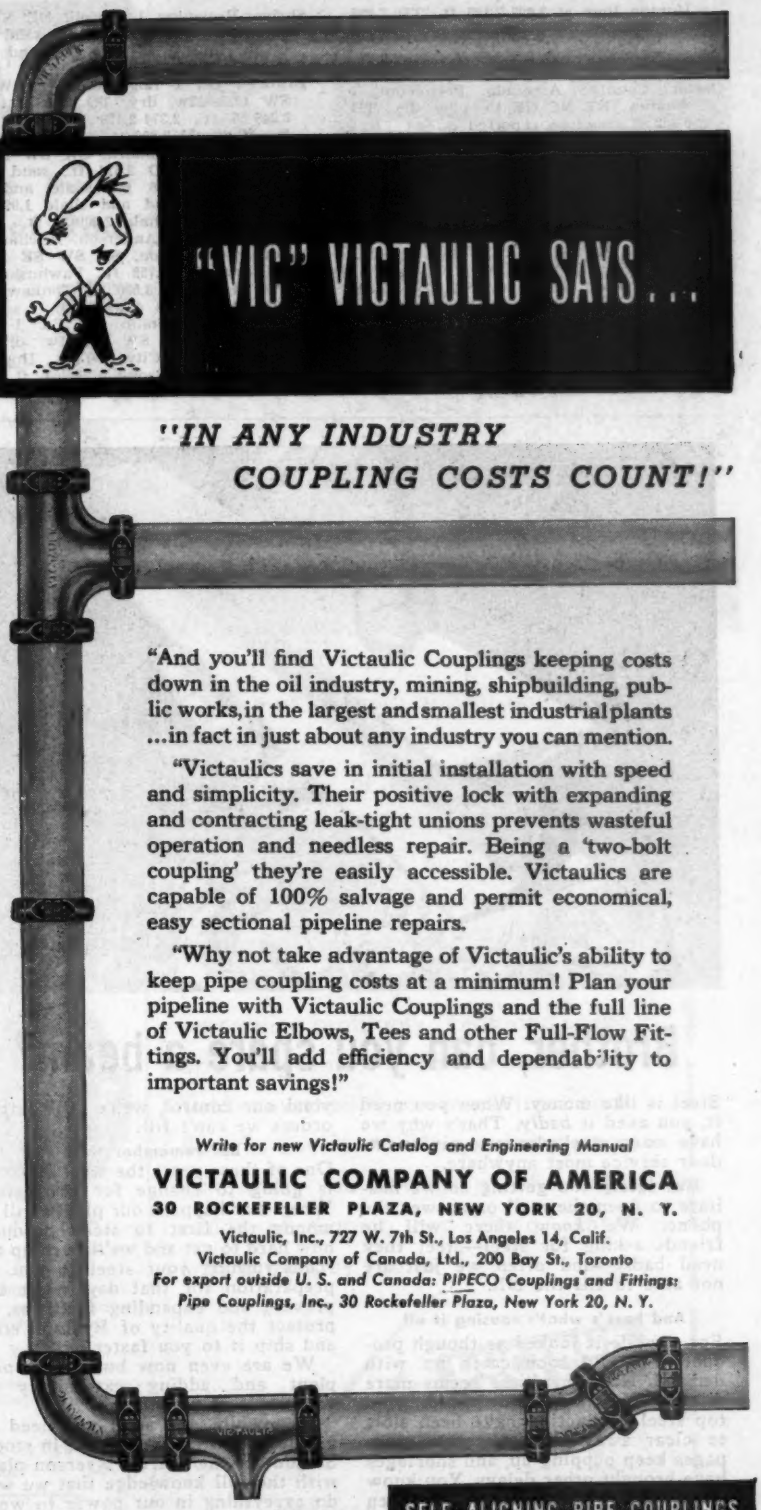
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Hunton lime at 7,097-7,123 ft., TD 7,235 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: Amerada Petroleum 1 Smalley, NE NE NE 19-4s-3w, dry, TD 6,852 ft., no tops reported.

Comanche County: George S. Collins 1 Huddleston, NW NW SE 11-1s-14w, dry, TD 2,055 ft., Pontotoc 380 ft., conglomerate 720 ft., Arbuckle conglomerate 980 ft., granite 2,052 ft.

Cotton County: C. P. Burton 1 No-Wook-Ah-Ker, SE SE SE 12-3s-12w, dry, TD 1,571 ft., sand 1,235-1,300 ft.

J. Ben Russell 1 Zachery, SE SE NE SE 29-3s-10w, dry, TD 1,682 ft., sandy shale 1,210-34 ft., broken sand 1,236-66 ft., conglomerate 1,266-76 ft., sand and shale 1,276-1,300 ft., conglomerate 1,300-05 ft., sand 1,340-47 ft., sand and shale 1,361-73 ft., sand 1,490-92 ft.

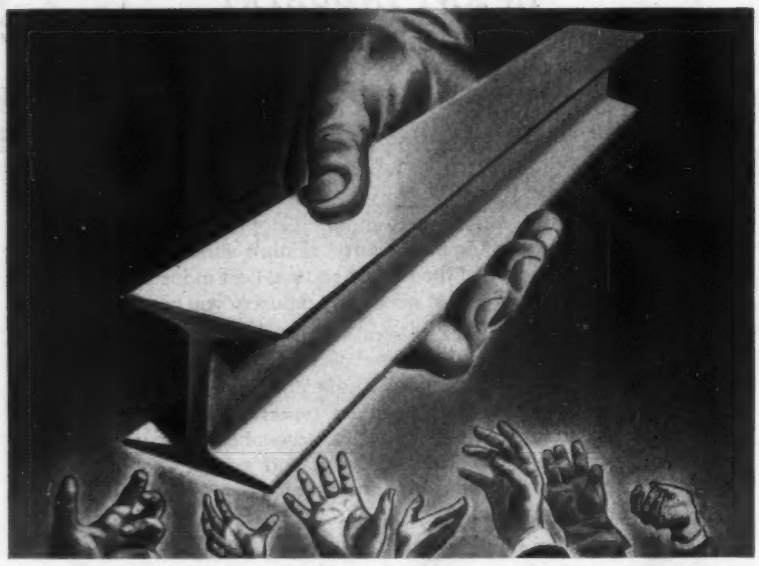
Shriver-Browning 1 Powell, NE NW SE 20-4s-11w, dry, TD 2,012 ft., sand 1,738-49 ft., lime 1,783-1,807 ft., sand 3,000-05 ft.

Bridwell Oil 1 Roger Top-Pi, SW NW SW 12-5s-12w, dry, TD 2,886 ft., sand 2,348-56 ft., 2,374-2,418 ft. and 2,429-34 ft., Megargel 2,800-41 ft.

D. H. Bolin 1 Kinaird, SW SW NE 26-5s-12w, dry, TD 2,514 ft., sand 830-55 ft. and 1,016-86 ft., shale and lime 1,810-40 ft., sand and shale 1,990-2,025 ft., lime and shale 2,209-33 ft.

Garfield County: Anderson-Prichard Oil Corp. 1 Donahoe, SE SW SE 28-21n-4w, dry, TD 4,758 ft., Pawhuska lime 2,778 ft., Oread 3,530 ft., Tonkawa lime 3,738 ft., Layton 4,724-48 ft.

Garvin County: Sohio Oil Co. 1 Goldfeder, NE NE SW 9-3n-1w, dry, TD 4,650 ft., Belle City 3,807 ft., Hogshooter 4,148 ft., Bromide 4,468 ft., sand 4,628 ft.



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RYERSON STEEL

West Edmond Unitization Application Filed

(Continued from page 42)

tion was determined after a study of all available data.

Natural-Gasoline Plants

The unit will not own the natural-gasoline plants serving the field. However, contracts will be executed between the plants and the unit by which the plants will process the gas production for a fixed charge. These contracts will be of mutual benefit in providing processing facilities for the unit's gas production and a source of supply for these plants. The unit retains title to all products and the residue gas. The plants will act as agents for the unit in final disposition of the products and residue gas.

The Oil and Gas Conservation Department of the Corporation Commission favors adoption of unitization plans for operation of oil fields. Whenever operators can agree upon an equitable program the state will benefit since it promotes oil and gas conservation and the greatest ultimate recovery of oil and gas.

Weston Payne, vice president, Anderson-Prichard Oil Corp., has served as chairman of the West Edmond Operators Committee since its inception in July 1945. Earl Wallace, vice president, Sohio Petroleum Co., succeeded C. S. Sanders, Stanolind Oil & Gas Co., as chairman of the steering committee January 1, when Sanders resigned. Other members of the steering committee are William H. Atkinson, consulting geologist; Jack H. Stewart, Atlantic Refining; D. B. Dow, Cities Service; Walter Stegmeir, Fox & Fox; S. G. Sanderson, Gulf; A. H. Proctor, Magnolia, assisted by Charles Hudson; Charles P. Dimit, Phillips; Frank Willibrand, Sohio; J. E. Roth, Tide Water Associated; Herman Wegener, independent operator, and R. E. Nelson, Stanolind.

The engineering-geological subcommittee is composed of P. T. Amstutz, Jr., Sohio, chairman; Jack Tarner, Phillips; Dave Dooley, Stanolind, acting for Roy Smith; Dr. Rudolph Brauchli, Anderson-Prichard, assisted by A. H. Richards; Lloyd Gray, Gulf; Carlos Ferguson, Magnolia, and Atkinson.

The legal subcommittee is composed of R. M. Williams, Phillips, chairman; W. W. Heard, Stanolind; W. H. Brown, Anderson-Prichard, and George Hazlitt, Sohio.

The plant subcommittee is composed of E. A. Renfro, Stanolind, chairman; Frank Willibrand, Sohio; Ray Carter, Continental; E. C. LaFevre, Cities Service, and Frank Matheny, Phillips. (Other details on the West Edmond unitization plan were published in The Oil and Gas Journal, December 14, page 70).

SAVES MANPOWER!

Norris Clutch Type Valve Puller Eliminates Extra Pulling of Rods To Pull Lower Valve . . .

This is no time to *waste* precious manpower. This is an emergency that calls for the *conservation* of labor and the *saving* of time—and in pumping wells such a policy demands the use of the Norris Clutch Type Valve Puller. As part of your pumping string, this performance-proved device does *not* retard production or emulsify the oil. But it *is* ready at a moment's notice to pull the standing valve quickly, safely, positively, thus *saving* the extra run of the rods and the time and labor it involves. Desirable in peace, essential in war, it belongs in all pumping wells.

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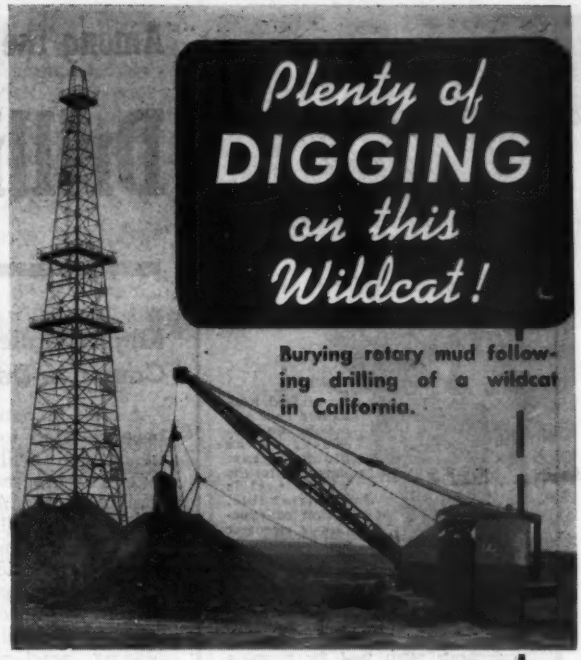

Plenty of DIGGING *on this Wildcat!*

Burying rotary mud following drilling of a wildcat in California.

Like all oil-field drilling operations, putting down this California wildcat meant plenty of earth to move, fast. No wonder a fast machine was chosen for the job. The Bucyrus-Erie 22-B ¾-yard dragline pictured here is one of number of Bucyrus-Eries that have proved their ability to handle oil field excavating profitably. Featuring speed, operating ease, durability and in-the-field convertibility to various front-ends, Bucyrus-Erie ⅜- to 2½-yard excavators can bring you savings on the entire range of digging and lifting. That's why it will pay you to

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Tulsa, Okla.	3-6143
Hobbs, N. M.	275-R

Among the Drilling Contractors

Kilgore College Announces Course in Drilling

A staff of petroleum engineers has been selected to offer a new course in oil-well drilling at Kilgore College. The program is under the sponsorship of the American Association of Oil Well Drilling Contractors.

The curriculum will include a class in drilling practices, mechanical drawing, and applied mechanics. A. J. Tatum will teach mechanical drawing, which will include blueprint reading, practical machine sketches, dimensioning, piping and wiring diagrams, map sketching, contouring, profiles, well and topographic symbols, well logs, graphs, lettering, and reproduction of sketches and prints.

Edison Bullard has been assigned as counselor of mathematics. The drilling practices will be subject to the supervision of A. W. Paine. Floyd Spears and Ralph Odiorne will offer applied mechanics.

The applied mechanics class will meet 5 hours a week. The object of the course is to apply the principals of mathematics, geometry, physics, and mechanics to oil-well drilling problems. The course will include rig layouts, weight indicators, hydraulic and mechanical brakes, identification of weights and grades of pipe and threads, cementing, logging, coring, directional drilling, drill-stem testing, and identification of formations drilled.

Fifteen hours a week will be spent in the shop practice and work with the equipment used in the drilling industry. A complete drilling rig will be set up on the campus and each student will learn to operate, maintain and repair each part of the machinery. The specific items include drilling engines, mud pumps, light plants, air compressors, hoists, rotary tables, drilling mud testing and control, care and use of wire lines and cat lines, safety and first aid.

Goll, Graves & Mechling is drilling-contracting firm on the Basin Oil Co., and Don F. Rayburn 4 William Borushko, in NE NW SW 9-19n-4e, Arenac County, Michigan.

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For the easiest brake known. It feeds off evenly. Standco never scores brake rims. See pages 3607-3613, Composite Catalog.

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Advisory staff of oil-well drilling course being offered for the first time in the United States at Kilgore College, under the sponsorship of the American Association of Oil Well Drilling Contractors. The men are: Kye Trout, A. W. Paine, Edison Bullard, and A. J. Tatum. Standing: Floyd Spears and Ralph Odiorne

TYPE "B" WORK BENCHES ARE DESIGNED ESPECIALLY FOR LIGHT RIGS

Here's an inexpensive, all-steel work bench that's "just right" for light drilling and workover rigs. There's lots of storage space in the four roller-mounted drawers and swing-out rag bin. A sturdy vise stand is mounted at a level with the work table. Steel pegs on the back apron permit tools to be hung where they are easily accessible. A central locking system prevents spilling contents during moving and the bench is skid-mounted for strength and easy handling.

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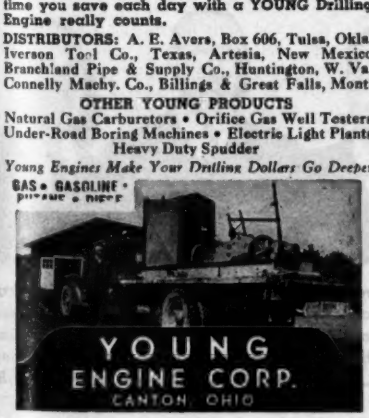

Meredith, Clegg & Hunt, Houston, are contractors for the Chicago Corp. 1 Dennis, located approximately 2 miles northwest of Eagle Lake, in Colorado County, Texas. The test is contracted to a depth of 11,000 ft. Same contractors are rigging up on the Humble Oil & Refining Co. 64 Paso Ancho, on the King Ranch in Kleberg County, Texas. Contract depth is 7,300 ft.

M. J. Delaney, contractor, was moving in derrick to start the M. E. Davis 1 Johnson, in the Edmund Quirk Survey, San Augustine County, Texas. This is a wildcat test 6 miles north of San Augustine.

Pabco Drilling Co., recently organized drilling concern, has announced election of W. G. Talbott, geologist of Wichita, as president and general manager. Offices of the firm are in the Petroleum Building, Wichita.

Wheless Drilling Co. has been awarded drilling contract on the Union Producing Co. 1 A. N. Floyd, at Big Island, Rapides Parish, South Louisiana. Location is ½ mile north of the 1 Belgard, deep discovery.

Perry-Busk-Ormiston is contracting firm on the Rex Oil & Gas Co. 1 C. Buddingh, in NW NE SE 28-5n-12w, Kent County, Michigan. The test is a wildcat.

Western Drilling Co. has completed the 1 Johnson, in SE SE SE 11-10-22w, Graham County, Kansas, as a dry hole at a total depth of 4,021 ft. The test was a farmout from Phillips Petroleum Co. and was supported by Stanolind Oil & Gas Co.

Transit Drilling Co., Oklahoma City, is contractor on the Anderson-Prichard Oil Corp. and Bay Petroleum Corp. 1 Putnam, in SE SE NE 25-17-14, Barton County, Kansas. The test, already under way, is 3 miles northwest of Hoisington and 3 miles east of the Carroll pool.

Bayou Drilling Corp. has contracted to drill the Sugarfield Oil Co., Inc., 1 Angelloz, in the Rosedale field area, Iberville Parish, South Louisiana. The test is scheduled to go to 10,500 ft.

Loffland Brothers Co. had the contract for the California Co. 29 McLaughlin, in NE NW 13-2-103, in the Rangely, Colorado, field, which was completed January 19 at 6,540 ft. for 337 bbl. per day. This is said to establish a drilling record for the field, as the well was completed 48 days after spudding. Loffland was also scheduled to start operations on a 10,000-ft. Frio test for Gulf Refining Co. in St. Landry Parish, southern Louisiana. The test, to be the 1 Louie Savoie, Unit 2, is west of production in the North Cankton field.

Designed for portable drilling rigs, workovers and for handling small sizes of drill pipe on the largest rigs, this tong has proven most popular and successful. All diameters from 2⅜" to 8⅝" are perfectly gripped by using proper size latch lug jaws. Tong can be equipped with either short or standard levers, dependent on derrick conditions. Hinge pin holes are flame hardened to insure long trouble-free life. This tong, like the BJ type "B," is designed to meet unusually tough service conditions.

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PERSONALS

Brandli Long Active As Official With Cities Service

HUNTING, fishing, and bridge are the chief hobbies of H. E. Brandli, new general manager of Cities Service Oil Co. (Pa.).

Brandli, 62, until his recent appointment was vice president in charge of export and wholesale sales and since 1921 has been in charge of Cities Service Export Oil Co. in New York. He joined Cities Service in 1912 and for the first 8 years was manager of various utility properties.

For his hobbies, Brandli holds memberships in the Westchester Country Club, the Pontiac Game and Fishing Club, Canada, and the Downtown Athletic Club.

The new general manager also holds positions in organizations closely related to his principal work. He is a director in Petroleum Advisers, Inc., a director and vice president of Oil Trades Association, president and a director of Cities Service Oil Co. of Argentina, and a member of the American Petroleum Institute.

J. U. Teague, production manager of Hogg Oil Co., has been elected chairman of the Houston chapter of the American Petroleum Institute. He succeeds **Lawrence O'Donnell,** Shell Oil Co., Inc. Elected first vice chairman was **John Neal,** Gulf Coast division manager, Lane-Wells Co., while **Tucker Pennington,** senior engineer, Humble Oil & Refining Co. was elected second vice chairman. **Orien Van Dyke,** chief engineer, Magnet Cove Barium Corp., was elected secretary-treasurer. Elected to 2-year terms on the advisory board were: **Warren Baker,** Gulf Publishing Co.; **Harold Decker,** Pan American Production Co.; **Paul Ward,** Ohio Oil Co.; **John Eckel,** Oil Center Tool Co.; **D. G. Hawthorne,** Houston consulting engineer. **I. W. Alcorn,** Pure Oil Co., and O'Donnell were elected to 1-year terms on the board.

Dr. John H. Maxson, former assistant professor of geology in the California Institute of Technology at Pasadena, has been named geologist of the Rocky Mountain division of Bay Petroleum Corp. **Harry B. Allen** has been employed as a geologist in the division.

Herbert Willetts, manager of the central marketing region of Socony-Vacuum Oil Co., Inc., has been appointed to the newly created position of national marketing manager. **H. T. Ashton,** currently manager of Socony-Vacuum's Lubrite Division, St. Louis, and president of the Western Petroleum Refiners Association, will be in charge of all marketing operations in 16 midwestern states comprising the company's central marketing region.

Claude E. Donaldson, traffic manager of Shell Oil Co., Inc., retired February 1 after 30 years of service with the company. Before joining Shell, Donaldson worked 12 years with Great Northern and Southern Pacific railways.

F. E. Hatfield, production superintendent; **F. J. Adams,** general agent, Fort Worth; and **H. B. Fuqua,** assistant to vice president, Houston, headed a party of Gulf Oil Corp. supervisors who made a tour of the company's operations in West Texas.

Ray E. Luton has been appointed manager of refineries for Ohio Oil Co. Luton has been general superintendent of refineries for the company since 1935. The new post was created in a revamping of the refining and marketing division.

A. B. Patterson retired from the service of The Texas Co. January 31, after having been an employe 33 years. He was assistant division manager, South Texas division, producing department.

Henry L. Rankin, assistant insurance commissioner of production and pipeline divisions of Gulf Oil Corp. and Gulf Refining Corp., has retired after 25 years of service.

F. S. Wood has been placed in charge of the lubricants group of the engine research laboratory in the Whiting refinery of Standard Oil Co. (Ind.) **E. L. Gregory** has become mechanical supervisor in the engine laboratory, and **Dr. J. C. Bailie** has been promoted to assistant chief chemist.

Frank O. Prior, chairman, Stanolind Oil & Gas Co.; **Jay P. Walker,** president, National Tank Co.; and **Allmand M. Blow,** vice president, Amerada Petroleum Corp., have been elected directors of the First National Bank & Trust Co. of Tulsa.

Max S. App has been named vice president in charge of production of General Petroleum Corp. to succeed **B. E. Parsons,** who retired recently. Parsons had been with General Petroleum since 1914. App joined the company as an engineer in 1912.

New officers of the North Texas Section, American Institute of Mining and Metallurgical Engineers, are shown here following their election in Fort Worth. Left to right are: Gordon H. Fisher, Gulf Oil Corp., Fort Worth, chairman; L. F. Peterson, Stanolind Oil & Gas Co., vice chairman for Fort Worth; John H. Murrell, DeGolyer & MacNaughton, Dallas, retiring chairman; E. B. Nicholson, Continental Oil Co., vice chairman for Wichita Falls; and E. B. Brownscombe, Atlantic Refining Co., vice chairman for Dallas

Al Wynn has been named division geologist and acting chief geologist for Macmillan Petroleum Corp. with headquarters at El Dorado, Ark.

Marion D. Olive formerly assistant petroleum engineer with Cotton Valley (Louisiana) Operators Committee, has resigned to join Barnsdall Oil Co. as petroleum engineer in the company's water-flood work at West Tepetate, La.

H. D. Henderson, Sohio Petroleum Co., has been elected president of the newly organized Houston Landmen's Association. Other new officers are: **J. Eric Beall,** Gulf Oil Corp., vice president; **J. E. Suttles,** Union Oil Co. of California, secretary; and **H. H. Kuester,** Standard Oil Co. of Texas, treasurer.

E. E. Hunter, Humble Oil & Refining Co., was elected chairman of the standing committee on federal taxation by the tax forum of the Mid-Continent Oil and Gas Association, meeting recently in Shreveport. **M. J. Lasseigne,** Shreveport, was named vice chairman.

W. Earl Dunn, Fluor Corp., and **E. W. Walker,** Western Gulf Oil Co., have been elected directors of the California Natural Gasoline Association, succeeding **J. S. Fluor, Jr.,** and **W. S. McAllister,** who have resigned.

T. L. Barks, of Barks-Williams Co., Ltd., London, petroleum products marketers, is at present visiting Mid-Continent and Gulf Coast oil centers. He is to return to England in March on the Queen Elizabeth.

Dr. Richard N. Meinert has been named assistant chief of research in the Tulsa laboratories of Carter Oil Co. For the past 10 years he has been engaged in research work for Standard Oil Development Co. at Bayway, N. J. He holds a Ph.D. degree in organic chemistry from Northwestern University. He served as a member of the faculty at Brown University, Providence, R. I., before entering the Bayway plant as a research chemist.

F. A. Hannaman, Jr., has been named head of a project-coordination group of the mechanical-engineering department of the Baton Rouge, La., refinery of Standard Oil Co. of New Jersey, Louisiana division. **O. R. Menton** has assumed supervision of the group in the same department. In other changes, **A. F. Blumer, O. C. Day** and **J. C. Mitts** became heads of refinery-inspection groups; **C. S. Pugsley** became assistant head of the equipment - inspection department; and **A. C. Matthies** became head of the engineering section of the petroleum technical-service department.

John B. Duckworth has been made an assistant director of research for Standard Oil Co. (Ind.) Except for 4 years in military service, he has been a member of the research department since 1936.

W. G. Ainsley, Sinclair Refining Co., has been appointed to a 3-year term as a member of the technical board of the Society of Automotive Engineers.

Sir Kenneth B. Harper, a director of Burmah Oil Co., has been appointed a director of Anglo-Iranian Oil Co., Ltd., succeeding **Gilbert C. Whigham** who resigned. Harper joined Burmah in 1912 and became general manager in 1929. He has been a Burmah director since 1937. Burmah holds upward of 20 per cent of Anglo-Iranian's stock.

Jeb B. Maebius, of Gulf Oil Corp., has been transferred from Michigan to Casper, Wyo., where he will be in charge of a district geological office being opened by the company.

Harry G. Taylor has been assigned as cost analyst in the Bayway refinery of Standard Oil Co. of New Jersey, responsible for coordination of all cost-reduction activities.

F. B. Plummer, professor of petroleum engineering at the University of Texas, has returned from northern Brazil where, with three Brazilian assistants, he made a 1,200-mile oil-exploration trip at the request of the Brazilian Government.

George H. McKay has been appointed head of the oil-movement and storage division of the Bayonne refinery of Standard Oil Co. of New Jersey, succeeding **Joseph F. Leddy,** who has retired. **Clayton H. Reigner** succeeded McKay as assistant department head; **Walter E. Thorn** succeeded Reigner as general foreman of the division's interrefinery pipe-line section; and **Floyd E. Perry** succeeded Thorn as assistant general foreman of that section.

John P. Allen has been appointed process superintendent at the Baltimore refinery of Standard Oil Co. of New Jersey, succeeding **Herman G. Gunter,** who has been transferred to Billings, Mont., with Carter Oil Co. Other Baltimore promotions include **W. Howard Snyder,** to general foreman of the cracking and rerunning division; **James W. Aires,** to assistant general foreman of the crude-distillation division; and **Frank Jones,** to general shift foreman.

Rolland W. McCanne, Ohio Oil Co., is the new president of the Wyoming Geological Association. **Thomas C. Hiestand,** Cities Service Oil Co., is vice president, and **Frank A. Morgan, Jr.,** secretary-treasurer.

Francis C. Savage, former assistant technical director of Magnolia Petroleum Co., has been placed in charge of coordination of the lubricating-oil blending and compounding activities of Socony-Vacuum Oil Co., Inc. He also will handle special assignments in the manufacture of lubricating oils.

J. H. Hall, superintendent of the products pipe-line department of Shell Oil Co., Inc., has been appointed manager of the marketing-engineering department.

Charles F. Weinaug, formerly a member of the research staff of Phillips Petroleum Co., has accepted the position of associate professor of petroleum research and petroleum engineering at the University of Texas.

Shifts

David C. Capps, superintendent, Amerada Petroleum Corp., Winnsboro, Tex., to Vernon, Tex.; **James S. Hopkins,** foreman, Amerada Petroleum Corp., Ardmore, Okla., to Buffalo, Wyo.; **R. R. Hawkins,** engineer, Case, Pomeroy & Co., Inc., Los Angeles to Roscoe, Calif.; **J. T. Recer,** superintendent, El Paso Natural Gas Co., Bennett, N. M., to Jal, N. M.; **L. D. Griffin,** superintendent, N. H. Wheless Drilling Co., Carthage, Tex., to Lake Charles, La.

E. L. Chapin, engineer, Stanolind Oil & Gas Co., Imperial, Tex., to Odessa, Tex.; **J. M. Meyers,** foreman, Helmerich & Payne, Inc., Levelland, Tex., to Crane, Tex.; **B. M. Nowery, Jr.,** engineer, Union Producing Co., Houston to Shreveport; **H. G. Williamson,** foreman, Atlantic Refining Co., Merryville, La., to Eunice, La.; **L. Decker Dawson,** geologist, Republic Exploration Co., Alexandria, La., to Fort Stockton, Tex.; **T. B. Whitson,** superintendent, Helmerich & Payne, Inc., Great Bend, Kans., to Oklahoma City.

G. A. Gresham, superintendent, Helmerich & Payne, Inc., Garden City, Kans., to Ulysses, Kans.; **Paul Weirich,** foreman, Phillips Petroleum Co., Lander, Wyo., to Rock Springs, Wyo.; **J. E. Orr,** geologist, Sinclair Oil Co., Lander, Wyo., to Woodward, Okla.; **Myron C. Metcalf,** geologist, Phillips Petroleum Co., Anadarko, Okla., to Oklahoma City; **W. B. Lafon,** engineer, Cities Service Oil Co., Bartlesville to Guymon, Okla.

Equipment Men in the News

Williams Heads Foreign Business

The board of directors of Worthington Pump & Machinery Corp., at its meeting of January 15 elected S. Riley Williams vice president in charge of foreign business. In his new capacity he will have responsibility for the sale of company products for export, as well as the administration of associated companies in South America and Europe. He will make his headquarters at the home office in Harrison, N. J.

Leland Equipment Announces Expansion Program

Harold Downs, president of the Leland Equipment Co., has announced expansion plans in which a group of men well known in the equipment industry have acquired substantial stock in the company. The new associates include Byron M. (Cap) Smith, who becomes vice president and general manager; John Timberlake, secretary-treasurer; and Joe Faust, Wayne Hood, and Carl Evans, who with Downs and other officers, complete the board of directors.

Leland Equipment Co., established 25 years ago in Tulsa, handles exclusive lines of construction machinery, tools and other petroleum equipment items. The company also maintains a large plant in Tulsa devoted principally to the manufacture of trailers, truck bodies, and other custom built bodies.

Smith has been associated with the Clarence L. Boyd Equipment Co., as manager of the Tulsa branch office. Hood, Faust, and Evans were employed by the Boyd firm. Hood will serve as manager of the branch office at Oklahoma City, and Evans will also be connected with the firm there. Faust will be located in Tulsa. Timberlake until recently was connected with the Johnson-Winston-Kiewit Construction Co. He has been identified with the equipment business for a number of years and has moved to Tulsa to assume his new duties.

New Service to L.P.G. Industry Offered by Anco

Anco Manufacturing & Supply Co., newly incorporated firm at Tulsa, announces a complete service for the supply and marketing of equipment and appliances for the liquefied petroleum gas industry, according to Paul R. Smith, president of the new firm.

Other officials of the new company include: Thomas C. Shaw, vice president; A. V. McMurray, sales manager; W. L. Abbott, assistant sales manager, and Marvin H. Kelly, chief engineer.

Appointments in Baroid

Baroid Sales Division, National Lead Co., announces that W. L. Heater, D. A. Sikes, and H. H. Farnham have been appointed assistants to the general manager of the division. Their headquarters will be in the Los Angeles office. Together with J. W. Hofstetter, assistant to the general manager and comptroller, Heater, Sikes, and Farnham will supervise, under the direction of General Manager G. L. Ratcliffe, all activities of the division. Heater will have charge of purchases, non-drilling-mud sales, and advertising. Sikes will have charge of drilling-mud sales and field service. Farnham will have charge of research and development, testing equipment, and well logging. Other appointments include: L. W. Huebel, manager, Gulf Coast division at Houston; E. W. Louden, field service manager at Houston; Fred B. Williams, manager, Pacific Coast division at Los Angeles; A. C. Cramer, assistant manager, Gulf Coast division at Houston; J. H. Beesley, sales manager, Mid-Continent division at Tulsa; Dixon D. Powers, distribution supervisor, Gulf Coast division at Houston, and K. K. Litman, Dallas sales representative.

Wood and Bloodworth Join Geophoto

George R. Wood has joined the staff of Geophoto Service, Denver, as photogeologist. He was formerly geologist with the Carter Oil Co. in Wyoming and previous to that was engaged in foreign exploration work with The Texas Co. B. L. Bloodworth, recently a captain in the Photo Intelligence section of the Army Air Corps, has become associated with the company.

Kobe Appoints Valley District Manager

RALPH FANTHUS

Kobe, Inc., has announced the appointment of Ralph Fanthus to the position of district manager in the San Joaquin Valley, with headquarters in the Haberfelde Building in Bakersfield. He will continue under the direction of R. J. Lyons, division manager in Huntington Park, Calif.

Insull Now With Stewart-Warner

Samuel Insull, Jr., has been appointed assistant to James S. Knowlson, chairman of the board and president of Stewart-Warner Corp.

Wallace President of Maloney-Crawford

S. P. WALLACE

S. P. Wallace has been elected president and treasurer of Maloney-Crawford Tank & Manufacturing Co., Tulsa, succeeding the late Harold D. Crawford. Wallace's election was announced following a meeting of the board of directors, consisting of O. W. Maloney, vice president; J. C. Highfill, vice president; Lawrence E. Davis; Joseph M. Handlan, and Wallace. Handlan, a son of the late Harold D. Crawford, and Davis, connected with the Crawford estates, were elected members of the board in December. They both reside in Parkersburg, W. Va.

Cameron Iron of California Holds Open House

Jeff Musolf, manager of Cameron Iron Works of California, announces formal opening of its new offices and warehouse at 1442 Haynes Avenue, Long Beach. Oil men throughout the West Coast are invited for lunch and refreshments at noon, February 15, to celebrate the occasion.

Le Tourneau Adds New Export Dealer

R. G. Le Tourneau, Inc., Peoria, Ill., has added Horacio Torrendell, S.A., Cuareim 2052-2082, Montevideo, Uruguay, as a new export dealer to serve the Republic of Uruguay, South America.

Ladish Changes Name

Ladish Drop Forge Co., Cudahy, Wis., has announced that the corporate name has been changed to Ladish Co. A general announcement of the new name will be made in early issues of leading business publications, emphasizing that no change has been made in either the company's organization or policies.

NEWLY ELECTED OFFICERS OF LOS ANGELES NOMADS

Landstrom Photo Service

Back row: Assistant Secretary J. A. Engstrand, Grant Oil Tool Co.; Secretary Byron N. Landis, Web Wilson Oil Tools; President Robert J. Eiche, export representative; Vice President Fred C. Ripley, International Derrick & Equipment Co.; Treasurer G. Waldo Moore, The Cavins Co.; Assistant Treasurer B. Reinhold, Abegg & Reinhold Co., Ltd. Front row: Member of Board of Regents Ted Sutter, Baker Oil Tools; Sergeant-at-Arms Lee J. Laird, Chiksan Co.; Deputy Sergeant-at-Arms Earle M. Boggess, Baker Oil Tools; Retiring President and Member of Board of Regents W. F. Bettis, M. O. Johnson Oil Field Service Co.